

DEPOSITIONAL ENVIRONMENT AND TREND OF THE
UPPERMOST PART OF THE VAMOOSA FORMATION
AND LECOMPTON LIMESTONE IN THE EASTERN
PART OF NORTH-CENTRAL OKLAHOMA

By

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PREFACE

The primary purpose of this study is to describe the geometry and internal features of the uppermost part of the Vamoosa Formation in north-central Oklahoma and interpret its trend and genesis. A secondary objective is to determine gross depositional trends in the overlying Lecompton Limestone. Included in the thesis are correlation sections, measured sections, thickness maps, paleocurrent diagrams, and petrographic features.

The author wishes to express his appreciation to his major adviser, Dr. J. W. Shelton, for assistance both in the field and in the writing of the manuscript. Appreciation is also expressed to Dr. G. F. Stewart and Dr. J. W. Trammell, who offered useful suggestions and advice during the course of the study. A note of thanks is given also to Dr. Trammell and Dr. T. H. Silker, for their assistance in preparing photomicrographs. The writer wishes to thank Dr. T. L. Rowland and Suzanne Mistretta, for providing data concerning the Lecompton Limestone. Appreciation is also extended to the Oklahoma Geological Survey for financial support, to Suzanne Spears, who drafted several of the figures, and to the typist, Grayce Wynd.

Finally, special gratitude is expressed to my wife, Cathey, our parents and our families, for their encouragement, understanding, and continued support during the study.

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CHAPTER I

ABSTRACT

Multistoried and multilateral lenticular sandstones, representing alluvial channel and deltaic distributary deposits are the dominant type of sandstone developed in the upper part of the Vamoosa Formation in the eastern part of north-central Oklahoma. The sandstone-bearing section between the Elgin Sandstone and the overlying Lecompton Limestone is informally designated as the Shaw Ranch Sandstone. Sandstone bodies are present in belts which are generally 1 to 3 miles in width and 80 to 120 feet in thickness. Individual alluvial channel deposits range from 200 to more than 300 feet in width, and are 20 to 25 feet thick. Deltaic distributaries are represented by deposits which are 100 to 200 feet wide, and 5 to 20 feet thick. Both types of units have sharp contacts. Sedimentary structures in lenticular sandstone bodies include medium-scale crossbedding, parting lineation, cut-out, and high-angle initial dip. Deformed bedding and small-scale crossbedding are more common in distributary sandstones than in alluvial sandstones. Paleocurrent directions, which are fairly consistent with trends of lenticular units, have an overall direction of N25°W. Texturally, lenticular sandstones range from very fine- to medium-grained and are subangular and well sorted. Significant constituents include intraformational fragments, wood fragments, and chert.

Thin-bedded sandstones, which represent a third type of genetic

unit in the study area, are thought to have been deposited primarily as delta-fringe sands in interdistributary areas. Total thickness of the thin-bedded units is generally less than 10 to 12 feet; widths are as much as two miles. Most contacts in these units are gradational. Sedimentary structures include ripple marks, small- and medium-scale crossbedding, bioturbated bedding, and parting lineation. Paleocurrent directions are diverse in orientation, with a primary average trend of N60°E and a secondary direction of N35°W. Thin-bedded sandstones are generally very fine- to fine-grained, subangular, and well sorted. Detrital muscovite flakes, finely-divided plant material, and fossils are characteristic constituents. Based on regional distribution of sandstone, paleocurrent directions, and the presence of chert as a significant constituent, the Ouachita uplift, possibly with the Arbuckle uplift, is considered to have been the dominant source area for Shaw Ranch sediments.

The Lecompton Limestone varies in its degree of development in the study area and ranges from 0 to 45 feet in thickness. Development of the Lecompton in the study area is thought to have been at least partially influenced by thickness variations in the underlying Shaw Ranch Sandstone and to some extent by paleostructure. Characteristic sedimentary structures include medium- and large-scale crossbedding, wavy bedding and interstratification. The Lecompton is thought to have been deposited in a subtidal to intertidal environment. Areas in which the Lecompton is more massively developed may correspond to algal banks or mounds typical of the Pennsylvanian of northeastern Oklahoma and southeastern Kansas.

CHAPTER II

INTRODUCTION

The Pennsylvanian Vamoosa Formation, which crops out in the western part of northeastern Oklahoma, consists of a complex of lenticular, rather massive sandstones, thin-bedded sandstones, and shales. Four divisions have been recognized in the Vamoosa; the uppermost is the subject of this study. This interval lies between the overlying Lecompton Limestone and the underlying Elgin Sandstone. It contains lenticular and thin-bedded sandstones, shales and, locally, thin limestone.

The study area, extending from T14N to T20N, R5E to R8E, and T21N to T25N, R6E to R9E, covers portions of five counties and includes both a northerly-trending outcrop belt, and an area of shallow subsurface to the west (Figure 1).

Objectives

The determination of the trends and environments of deposition of sandstone in the study interval is the primary objective of this thesis. This objective is largely dependent, however, on a corollary objective, the establishment of a correlation framework for sandstone in the interval. Another purpose of this study is to determine gross depositional trends in the Lecompton Limestone.

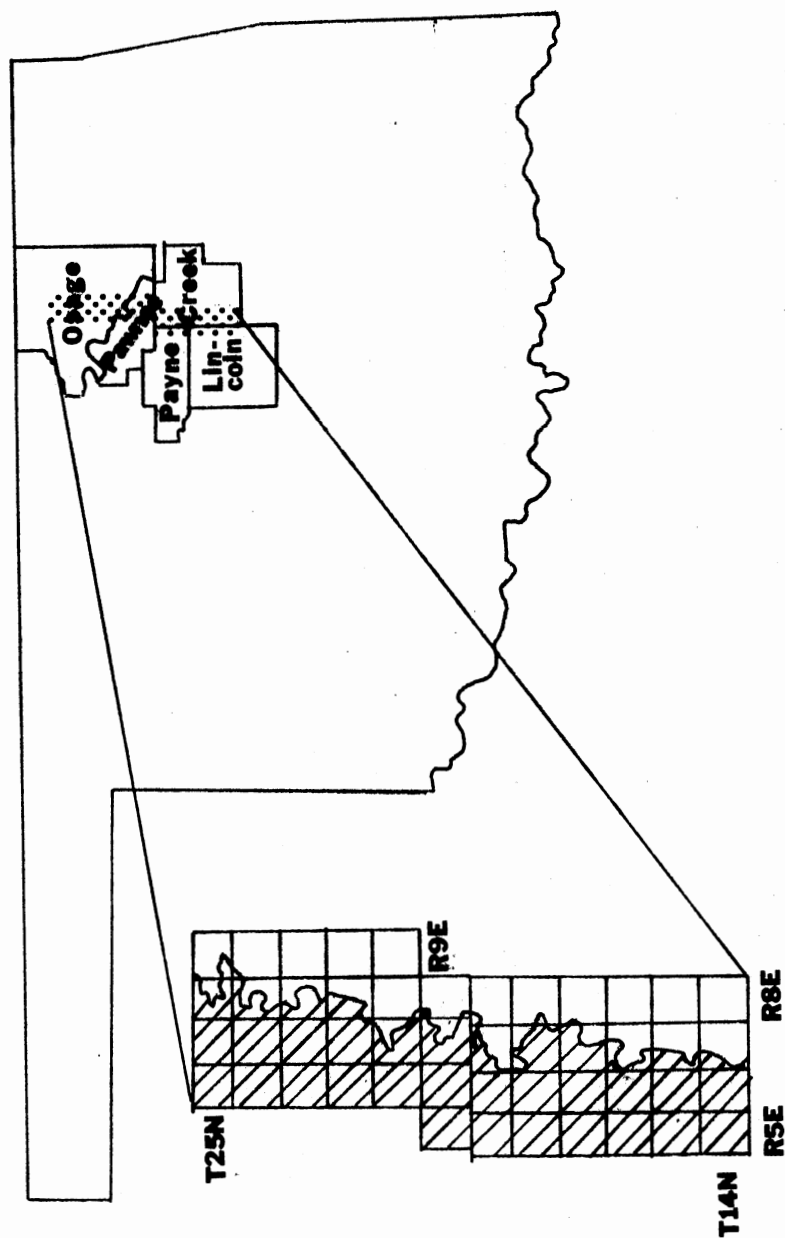


Figure 1. Location of Study Area

Methods

Stratigraphic correlation of rocks on the surface are based to a large extent on the work of Oakes (1959), Greig (1959), Russell (1955), and Shannon (1954). The established correlations were modified where the transgressive-regressive couplet represented by the interval does not coincide with the previously mapped units. Correlation of surface data to subsurface data was accomplished through the use of graphic measured sections and electric logs and the concept that the transgressive units provide good "markers." A network of correlation sections was utilized in maintaining an acceptable level of accuracy in correlation and in determining sandstone geometry.

Data from some 40 measured sections provide information concerning sandstone geometry and internal features, including directional data. Directions of sediment transport were determined from plots of paleocurrent indicators on azimuth diagrams. Subsurface data were derived from electric logs of 450 wells with fairly uniform geographic distribution. These data were the basis for a net sandstone thickness map and a thickness map of the interval.

Depositional trends in the Lecompton Limestone are based on electric logs and outcrop data. Mistretta (1975), in an unpublished thesis on the petrography and environments of deposition of the Lecompton Limestone, and Rowland (Shelton and Rowland, 1974) provided the basis for the study of gross features of the Lecompton, with emphasis on geometry and sedimentary structures.

CHAPTER III

STRATIGRAPHIC FRAMEWORK

The Vamoosa Formation, basal unit of the Virgilian Series, is overlain by the Lecompton Limestone and underlain by the Tallant Formation. According to subsurface terminology, the Lecompton is the lowermost unit of the Pawhuska formation, but on outcrop beds overlying the Lecompton are assigned to the Ada Formation. At its southern margin, north of the Ouachita and Arbuckle Uplifts, the Vamoosa apparently overlies the Tallant unconformably. There it is composed of coarse-grained sandstone with conglomerate.

Northward from the Okfuskee-Creek County line (Figure 2), four units composing the Vamoosa are distinguished on the basis of thin, intervening shales. North of the study area and in southern Kansas, the Vamoosa is composed of sandstones, shales, and limestones, which together form a typical Kansas megacyclothem.

Sandstone units in the upper part of the Vamoosa have been mapped in both Creek County by Oakes (1959), and in Pawnee County by Greig (1959). In southern and central Osage County, sandstone development on outcrop is poor. However, Russell (1955) noted that sandstone is locally present on outcrop in the Hominy area. Sandstone in the upper part of the Vamoosa is present in southern Kansas, where apparently it is the equivalent of the Stull Shale, the uppermost member of the Kanwaka Formation. A map of two sandstones in the interval of the

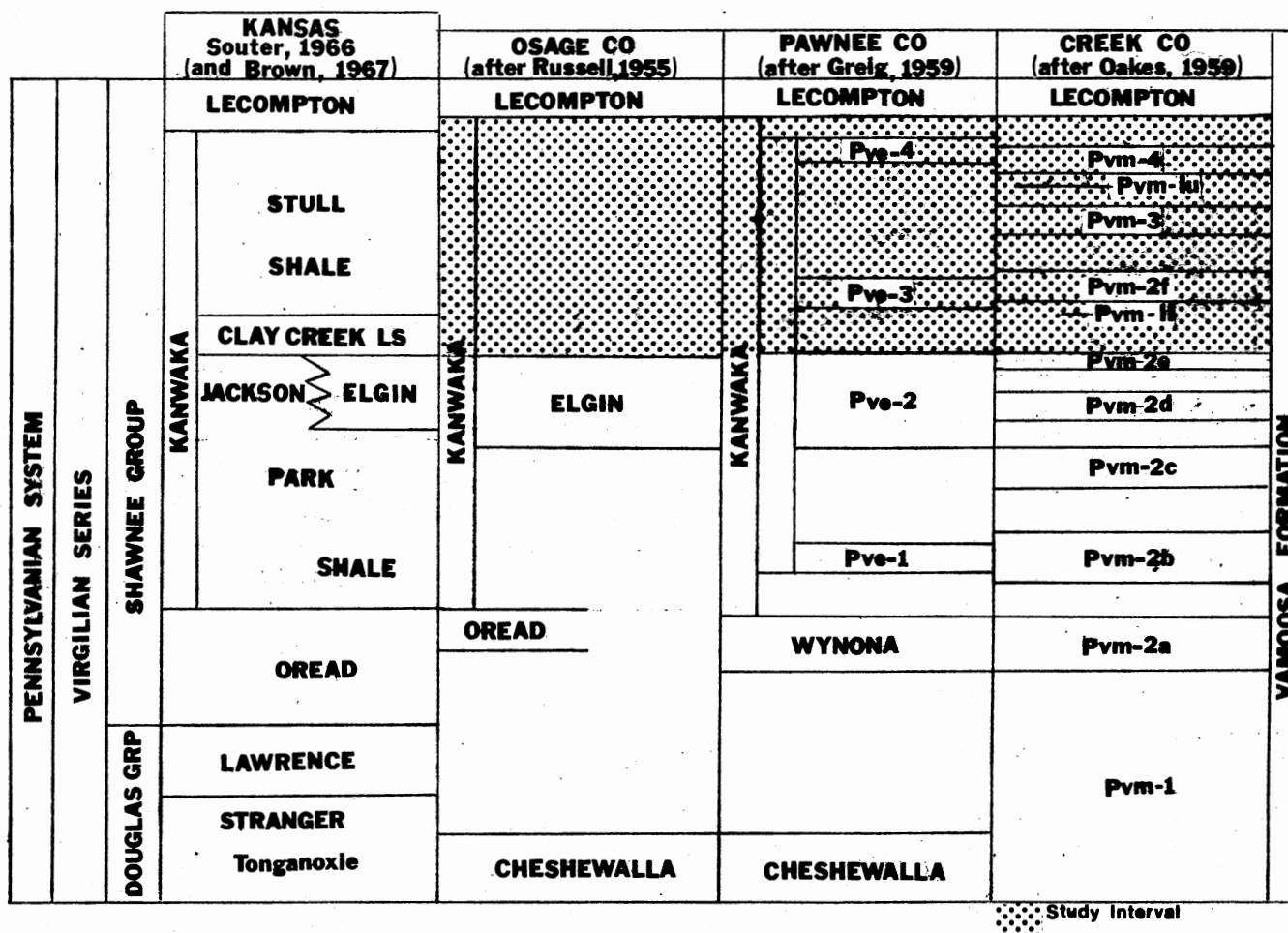


Figure 2. Stratigraphic Correlation Chart, Showing Position of the Uppermost Part of the Vamoosa Formation

Stull Shale in Oklahoma (Souter, 1966) suggests that sandstone in the interval may extend in the subsurface as far west as R15W, or 125 miles from the outcrop.

In the area of study, sandstone in the upper part of the Vamoosa lies between the overlying Lecompton Limestone, basal member of the Pawhuska Formation, and the underlying Elgin Sandstone. Both the Lecompton and Elgin are prominently developed, and sandstone between them is herein designated "Shaw Ranch Sandstone" after the exposure of greatest thickness (55 feet) adjacent to the L. W. Shaw Ranch, 3.2 miles south of the intersection of Oklahoma highways 99, 33, and 16. It is thought that this informal name is more definitive than the designation of "Hoover 'zone'" by Lukert (1949). As defined by Lukert, the Hoover "zone" includes both the upper part of the Vamoosa Formation and the lower part of the Pawhuska Formation.

The interval of study, which includes the Shaw Ranch Sandstone, ranges in thickness from 70 to 180 feet (Figure 3). Although the entire interval is not exposed at any locality, as much as 80 to 100 feet of the interval are exposed in the Drumright-Shamrock area. The interval may be regarded as a transgressive-regressive couplet, because the lowermost part of the Lecompton Limestone corresponds to the upper transgressive marker and fossiliferous maroon-to-gray shale corresponds to the lower marker. In most areas, the Lecompton is easily identified both on outcrop and in the subsurface (Figures 3 and 4). The lower shale is persistent throughout the area, with the best exposures north and south of Drumright on Oklahoma highways 99 and 16, respectively (Figures 3 and 5).

O.F. Warren
Anderson NO. 1
SW SW NW
Sec. 3, T17N R6E

Composite Section
T17N R7E

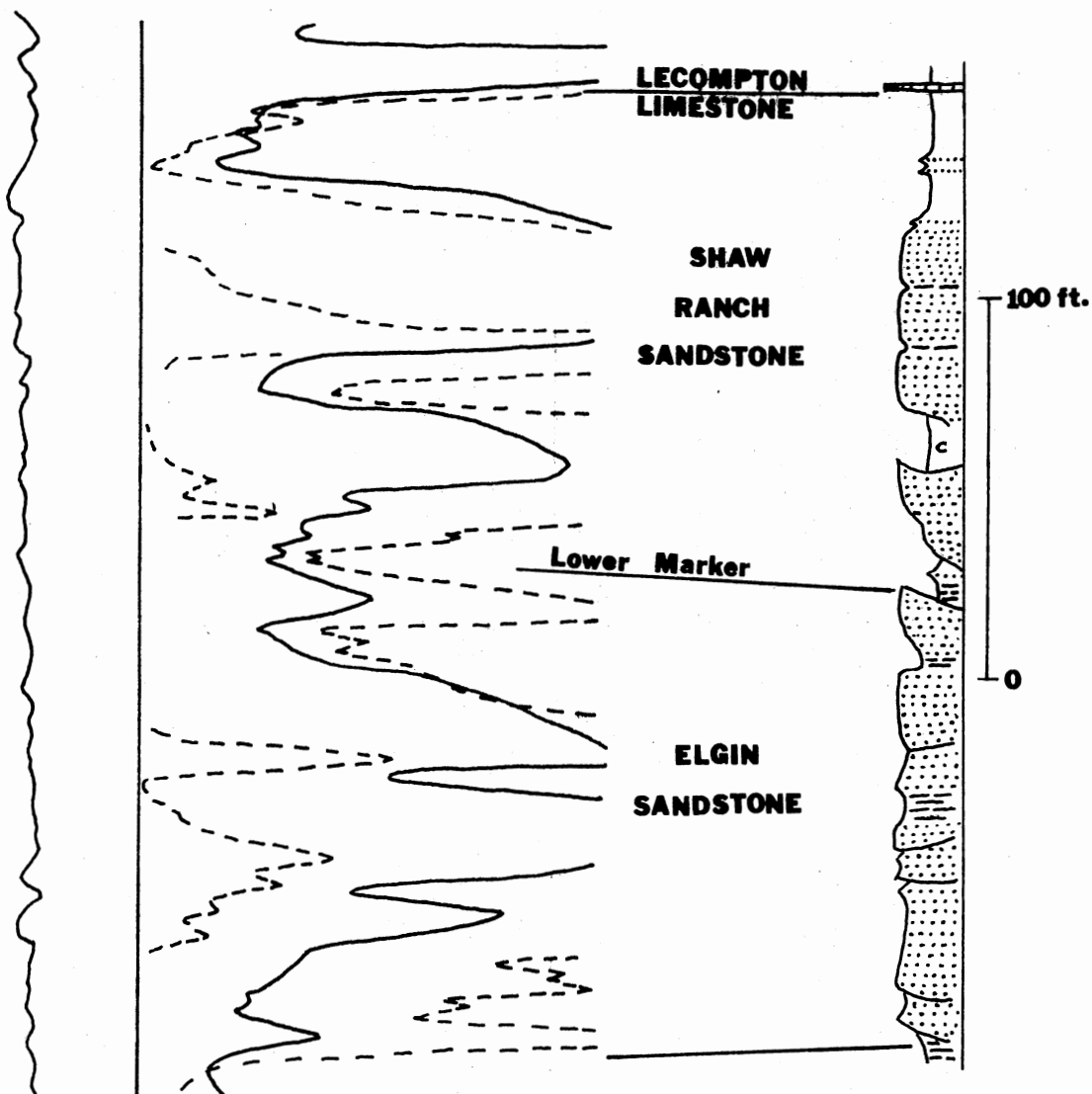


Figure 3. Stratigraphic Interval of Shaw Ranch Sandstone,
Outcrop to Subsurface Showing Upper and Lower
Markers



Figure 4. Upper Marker (Base of Lecompton Limestone) on Outcrop in Sec. 28, T19N, R7E. Thickness of the Lecompton is 12.5 ft.



Figure 5. Lower Marker on Outcrop in Sec. 8, T18N, R7E. The Marker is in a Maroon-to-gray Shale, 10 to 20 ft. Thick

CHAPTER IV

GEOMETRY

Geographic Position and Trend

Major development of the Shaw Ranch sandstone is generally restricted to the southern part of the study area (Figure 6). Beyond the limits of the study area, sandstone development continues to the west in the subsurface and may reach a distance of up to 125 miles from the outcrop belt (Souter, 1966). Sandstone may also be present as far north as the northeastern part of Kansas. It extends southward beyond the area of delineation of its lower contact as a part of the undifferentiated Vamoosa Formation.

Although sandstone trends in the study interval reflect a considerable degree of variability, the overall trend is northwesterly (Figure 6). The most prominent feature is an anastomosing belt which bifurcates both toward the southeast and northwest. Local trends along the belt vary from west to north-northeast. Several exposures just east of Drumright in Creek County also permit a fairly good reconstruction of the local diversity in the orientation of channel trends (Figure 7). The trends of these sandstones range from $N60^{\circ}W$ to $N25^{\circ}E$. Major sandstone trends in the Shaw Ranch Sandstone and those in the underlying Elgin Sandstone do not coincide in their geographic positions. Although both sandstone members have overall northwesterly trends, local trends

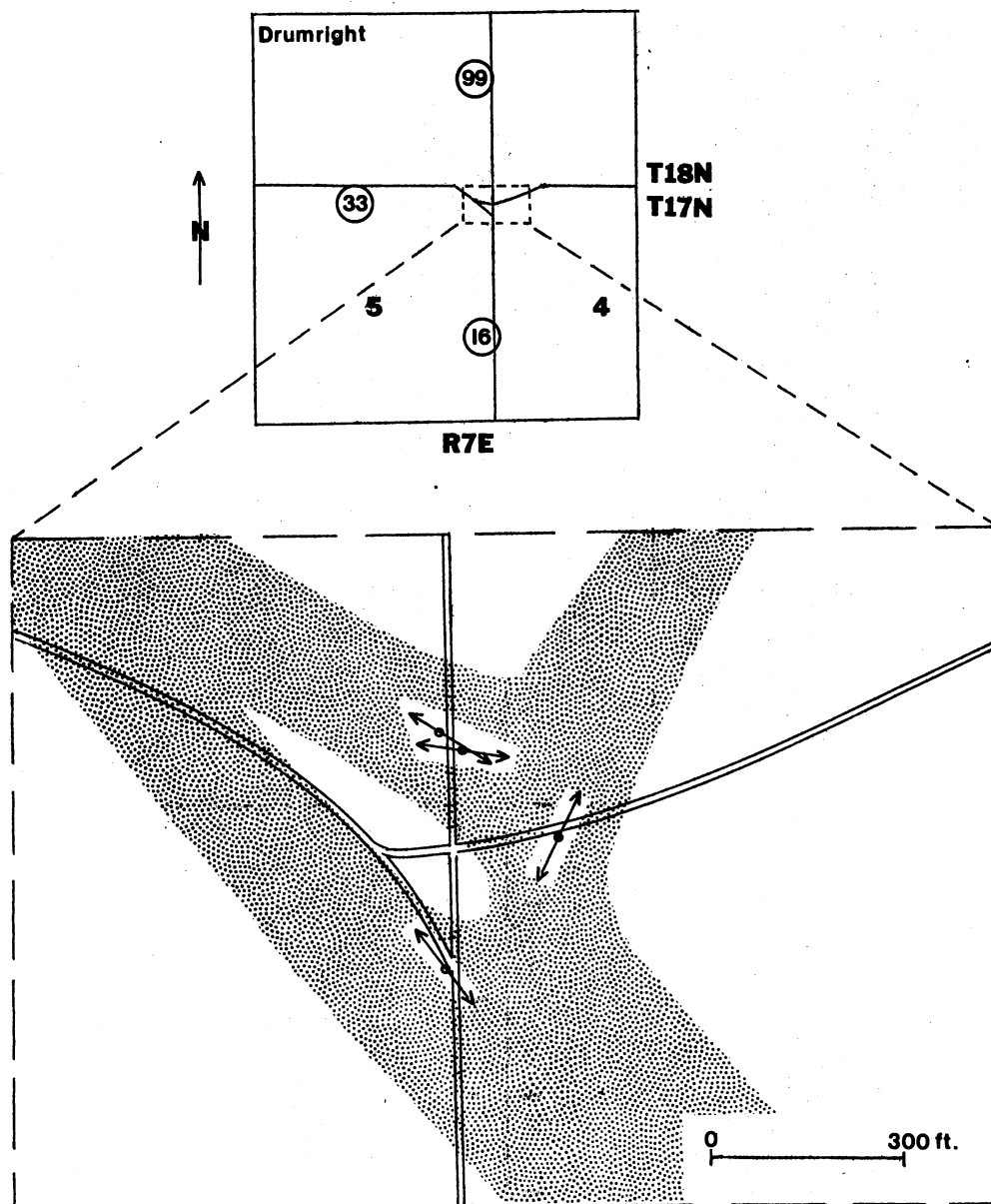


Figure 7. Local Diversity in Channel Orientation in Secs. 4 and 5, T17N, R7E. Exposed Edges of Lenticular Sandstones in This Area Permit Fairly Accurate Measurements of Trends

in the Shaw Ranch generally cross local trends in the underlying Elgin (Terrell, 1972) at rather large acute angles. In one area (T19N-T20N, R6E-R7E), easterly trends in these sandstones are essentially parallel but slightly offset in geographic position.

Thicknesses of the interval containing the Shaw Ranch Sandstone (Figure 8) show some degree of correlation with major sandstone trends, particularly in the southern part of the study area. To the north, trends of interval thickness show local diversity, and a regional pattern may be obscured by the narrow study area. However, the interval is consistently thin in the northern part of T25N, suggesting a westerly or northwesterly trend. The interval thickness map of the Shaw Ranch Sandstone is quite dissimilar to that of the Elgin Sandstone (Terrell, 1972).

Width and Thickness

On outcrop, the Shaw Ranch Sandstone is characterized by lenticular sandstones of various sizes and by thin-bedded sandstones. At least two types of genetic units are recognizable in the lenticular sandstones and are differentiated primarily on the basis of thickness and to some extent by width (Figure 9). The different sizes of lenticular sandstone bodies are shown on outcrop particularly well in the central part of T17N, R7E. In Sec. 16, T17N, R7E, the lower part of two lenticular units is 6 feet in thickness and 150 feet in width, whereas the partially eroded overlying lenticular unit is greater than 15 feet thick and more than 300 feet wide. Maximum thickness of the larger of these two lenticular units is about 25 feet. Widths of lenticular sandstones in the lower part of the interval can be

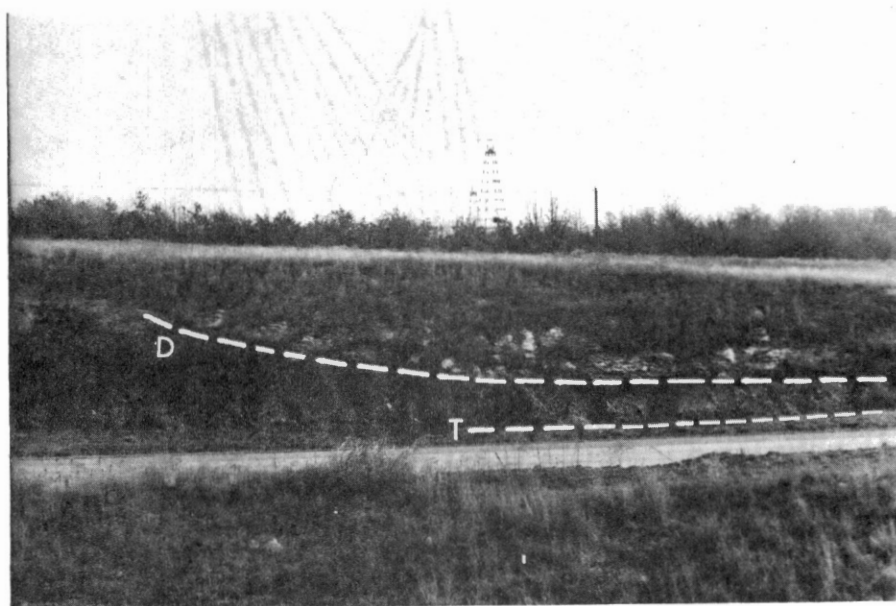
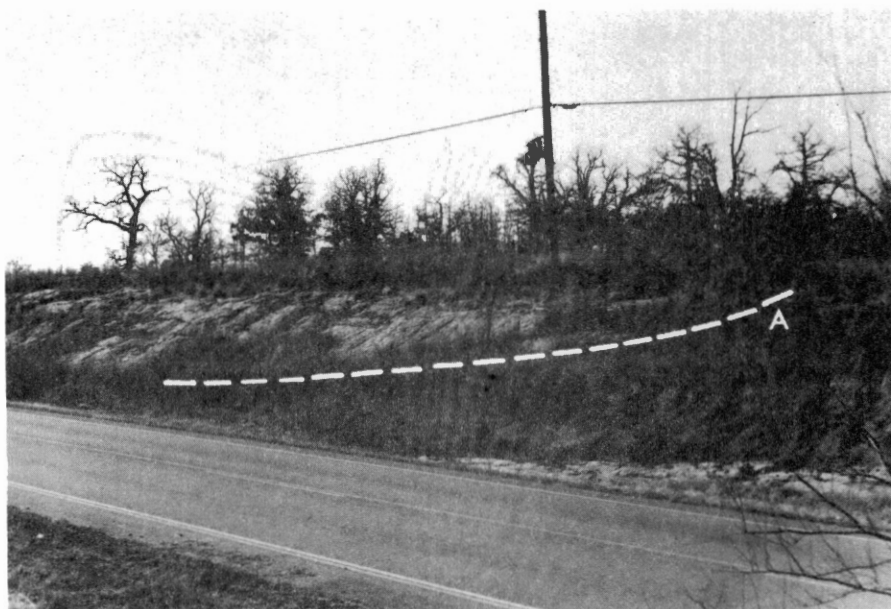


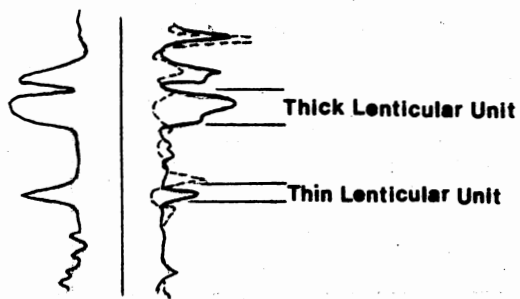
Figure 9. Two Sizes of Lenticular Genetic Sandstone Units. Alluvial Sandstone (A) in Sec. 16, T17N, R7E is at Least 15 ft. Thick and 300 ft. Wide. Distributary Sandstone (D) in Sec. 8, T18N, R7E is 12 ft. Thick and Less Than 200 ft. Wide. T=top of Elgin Sandstone

determined on outcrop in Secs. 4 and 5, T17N, R7E. The units range in width from 100 to 200 feet and in thickness from 12 to 25 feet. Two sizes of lenticular genetic units in the subsurface are illustrated in Figure 10.

Multistoried sandstones are indicated primarily by their thicknesses (Figure 6), and in the subsurface they are commonly stacked in such a manner that genetic units are obscured (Figure 10). Multilateral units are suggested by the widths of belts. Vertical and lateral stacking of genetic units is especially common in the upper part of the study interval. In the subsurface, multistoried and multilateral units are as thick as 120 feet and generally 1 to 3 miles wide. Widths up to 5 miles are present where two or more major trends coalesce.

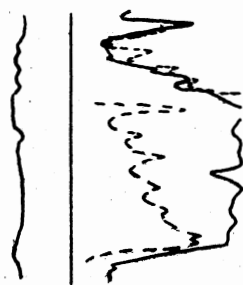
Thin-bedded sandstones predominate in the lower part of the study interval and in the northern part of the study area. Individual sandstone beds range from .5 to 1.5 feet in thickness, and the total thickness of sandstone and interbedded shale generally is less than 12 feet. However, a multistoried sequence of thin-bedded sandstones is apparently present in Sec. 18, T19N, R5E, where the interval containing sandstone totals 25 feet (Figure 10). Although thin-bedded units are generally more persistent laterally than the lenticular units, the average lateral continuity is limited to 2 miles on the surface and 3 miles in the subsurface, based on field observations and correlation sections (Figures 11-13). In T19N, a thin-bedded sandstone has a present maximum width of about 3 miles. The sharp lateral contact of the thin-bedded unit with a lenticular sandstone in this area indicates that the original lateral extent may have been as much as 5 miles.

Blackwell Oil and Gas Co.
White No.1
NE SE SW
Sec. 6, T18N, R5E



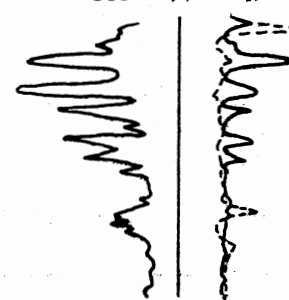
A

Mulberry Oil Co.
Naumann No.1
SE NW SE
Sec. 2, T17N, R5E



B

Midwestern Constrs. Inc.
Wetzel No.1
NE NE NW
Sec. 18, T19N, R5E



C

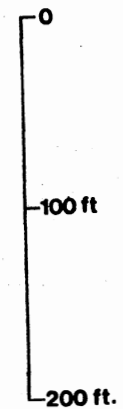


Figure 10. Sandstones in the Subsurface
(A) Two Sizes of Lenticular Genetic Units
(B) Multistoried Lenticular Sandstones
(C) Multistoried Thin-bedded Sandstones

Boundaries

The interval of study is generally well defined in most of the study area (T16N to T21N), with sharp upper and lower boundaries both on outcrop and in the subsurface (Figures 11-13). In the northern part of the study area, particularly T22N to T24N, delineation of the upper contact is more difficult. The obscure nature of the upper contact in this area is attributed to changes in the thickness and character of the Lecompton Limestone, together with variations in interval thickness. South of the study area, the interval is poorly defined, and the Vamoosa has not been differentiated into separate units.

Lenticular sandstones have sharp upper and lower contacts and abrupt lateral contacts (Figures 9 and 10). The nature of these contacts may be difficult to discern where multistoried units consist of a single lithology, such as at the type locality for the Shaw Ranch Sandstone in the northwestern part of T17N, R7E. Thin-bedded sandstones generally show gradational upper and lower contacts (Figures 10 and 14). These are well displayed in several exposures along Oklahoma highways 99 and 16. Lateral contacts of the thin-bedded sandstones are not commonly observed in the field, but correlation of subsurface data indicates that they are gradational except where in direct contact with lenticular units.

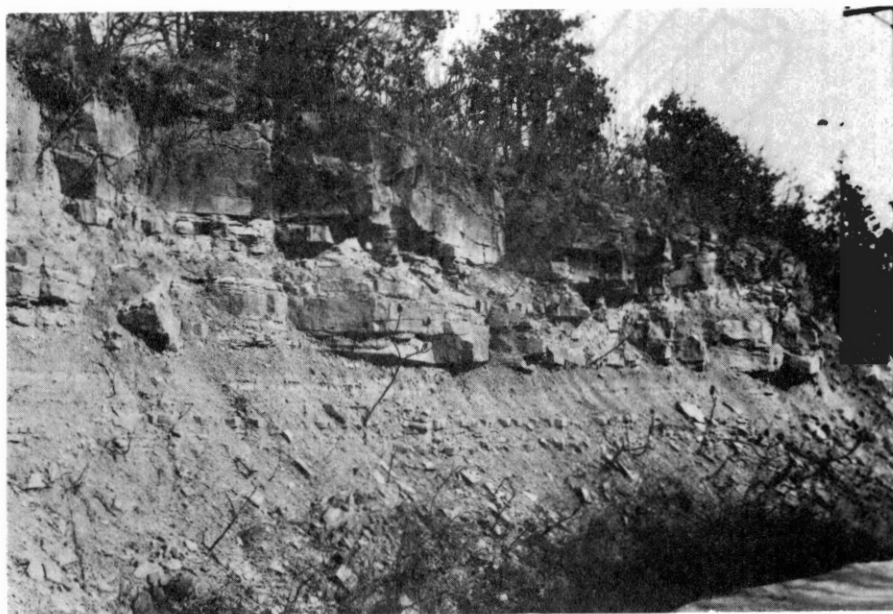


Figure 14. Thin-bedded Sandstone in Sec. 25, T20N, R7E, Showing Gradational Base and Interstratification. Approximately 15 ft. of Section are Exposed at This Locality

CHAPTER V

INTERNAL FEATURES

Sedimentary Structures

Significant types of sedimentary structures in the lenticular sandstones include: medium- and small-scale crossbedding, high-angle initial dip, parting lineation, convolute bedding, and massive bedding. A common vertical sequence of massive bedding, medium-scale crossbedding, and small-scale crossbedding or horizontal bedding, in ascending order, is present in lenticular sandstones in Secs. 4 and 21, T14N, R7E, and in exposures in the southern part of T17N, R7E (Appendix A).

Initial dip, as much as 35° , is a common feature along edges of lenticular sandstones (Figure 9). This sedimentary structure represents bank slope of channels and is associated with cut-outs. Three types of cut-out are present in the study area, and each is very well developed along Oklahoma highways 99 and 16 in the Drumright-Shamrock area. A small-scale cut-out, associated with the lower shale marker, is present at the top of the Elgin Sandstone. It is 2 to 5 feet deep and up to 75 feet wide. Sandstone fill of an intermediate-sized cut-out is 12 feet thick and 100 to 200 feet in width (Figure 9). Both small- and intermediate-size cut-outs are well developed in the northern part of T17N, R7E, and in T18N, R7E. An example of the largest type of cut-out is in Sec. 16, T17N, R7E (Figure 9). It is 20 to 25

feet deep and 200 to 300 feet wide. Small-scale cut-outs represent minor channeling, and larger cut-outs correspond to well developed channels.

Thin-bedded sandstones are characterized by medium- and small-scale crossbedding, low-angle initial dip, interstratification, ripple marks, sole marks, and parting lineation. Ripple marks in the thin-bedded sandstones are most common where sandstones are interbedded with shales. Parting lineation is also a common feature of these beds, some of which contain sole marks. Biogenic structures, such as burrows, trails, and bioturbated bedding, are prominent in some thin-bedded sandstones; they are generally absent from the lenticular units.

Paleocurrents

A total of approximately 130 measurements of paleocurrent indicators was made of medium- and small-scale crossbedding, parting lineation, initial dip, ripple marks, cut-out, and grain orientation. Bulk measurements of grain orientation were determined by various students through the use of conductivity-anisotropy. Directional data in the lenticular sandstones and in the thin-bedded sandstones were plotted on azimuth diagrams and analyzed separately for each locality (Figure 6). Composite paleocurrent diagrams were also prepared for each of the two sandstone types (Figures 15 and 16). Measurements in the southern area of sandstone development were almost entirely in lenticular sandstones. Those measurements north of the Cimarron River were primarily of features in thin-bedded units. Indicators thought to be most reliable in the interpretation of paleocurrent data for individual lenticular units are cut-out and initial dip. Parting lineation and ripple marks are the

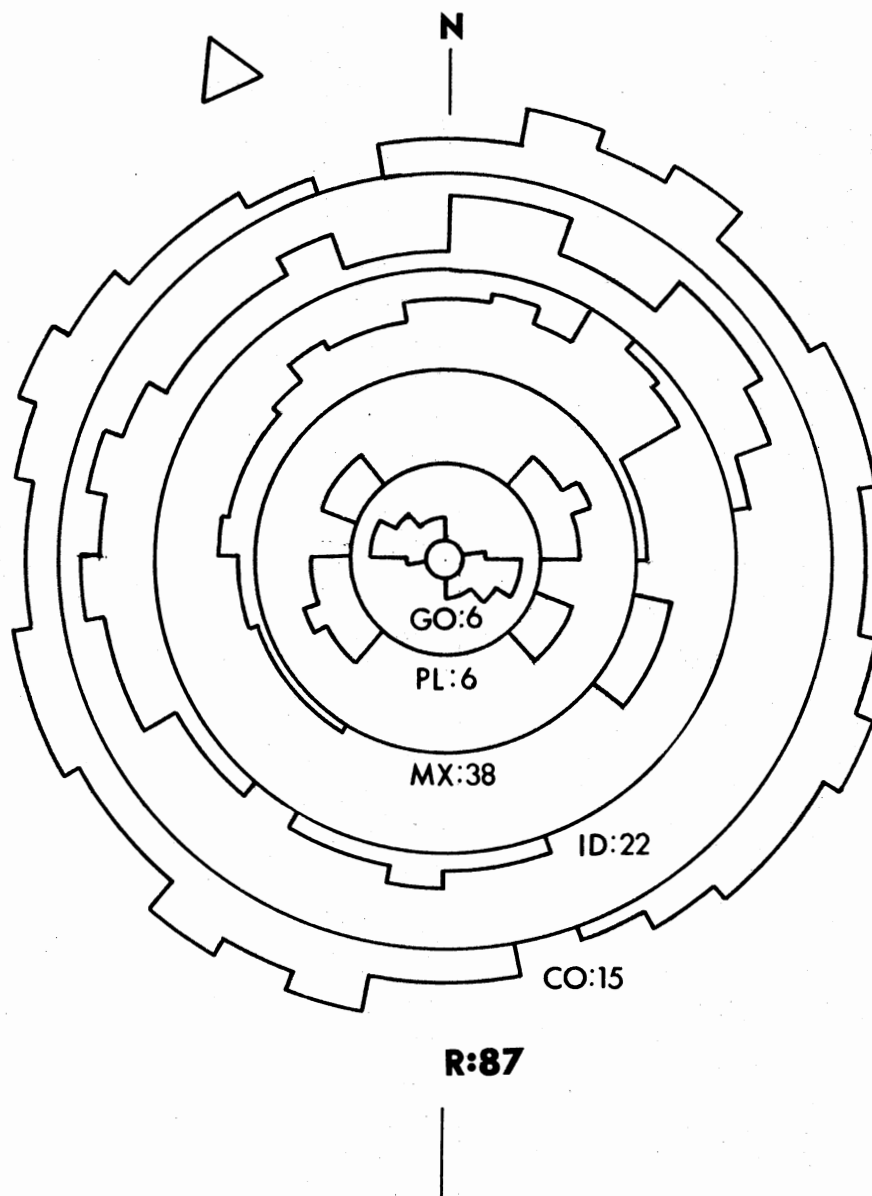


Figure 15. Paleocurrent Diagram of Lenticular Sandstones, Indicating an Overall Direction of $N25^{\circ}W$. CO=Cut-out, ID=Initial Dip, MX=Medium-scale Crossbedding, PL=Parting Lamination, GO=Grain Orientation, and R=Total Number of Readings. A 30° -Sliding Average was used in Preparation of the Diagram

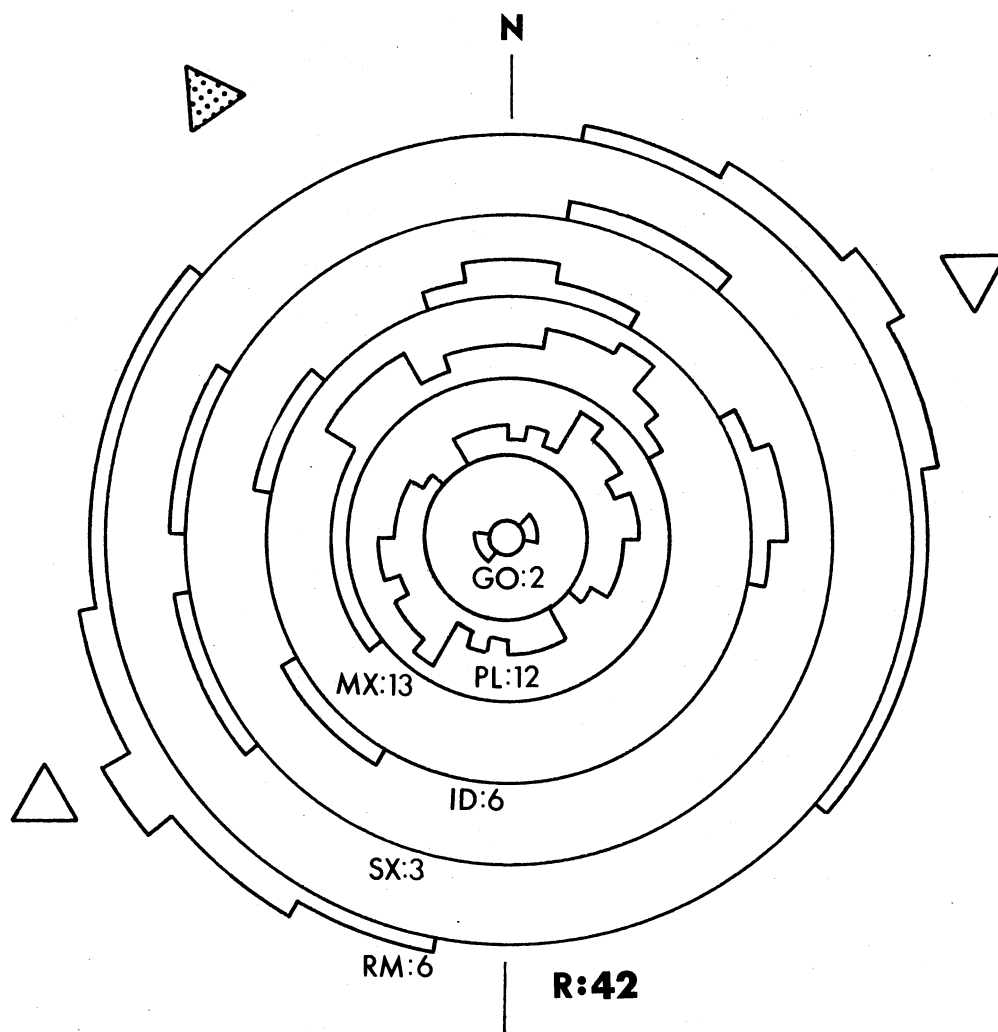


Figure 16. Paleocurrent Diagram of Thin-bedded Sandstones Indicating a Primary Trend of $N60^{\circ}E$, and a Secondary Direction of $N35^{\circ}W$. RM=Ripple Marks, SX=Small-scale Crossbedding, ID=Initial Dip, MX=Medium-scale Crossbedding, PL=Parting Lineation, GO=Grain Orientation, and R=Total Number of Readings

most reliable directional features in the thin-bedded units. Paleo-current indicators show an average direction of $N25^{\circ}W$ for the lenticular sandstones (Figure 15). This direction is consistent with the overall trend of major sandstone bodies (Figure 6). Thin-bedded units exhibit a primary average trend of $N60^{\circ}E$ and a secondary direction of $N35^{\circ}W$ (Figure 16).

Texture

Lenticular sandstone bodies are commonly fine-grained throughout, but in some cases they show an overall upward decrease in grain size. Upward-fining sequences are present in Secs. 4 and 21, T14N, R7E (Appendix A). The maximum average grain size of coarse-to-medium sand is present in the Drumright-Shamrock area. Lenticular sandstones are well sorted to very well sorted. Most grains are subangular; line contacts between grains, which are the most abundant type (Figure 17), probably are related to secondary outgrowths and pressure-solution. The thin-bedded sandstones are generally fine- to very-fine grained, subangular, and well sorted throughout the study area. Grain contacts in the thin-bedded units are similar to those in the lenticular sandstones.

Constituents

Petrographic analyses were based on estimates of grain frequencies in 10 thin-sections. All of the samples of the Shaw Ranch Sandstone are quartz-rich. Four of 5 samples of lenticular sandstones are quartz-arenites, with 2 to 3 percent feldspar (Figure 18). A sample from a locality southeast of Drumright is a quartz-rich subarkose, which

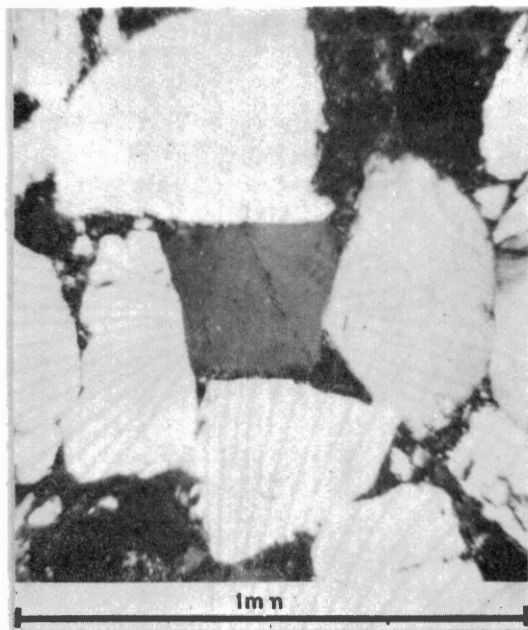


Figure 17. Line Contacts Between Quartz Grains in a Lenticular Sandstone From Sec. 5, T17N, R7E

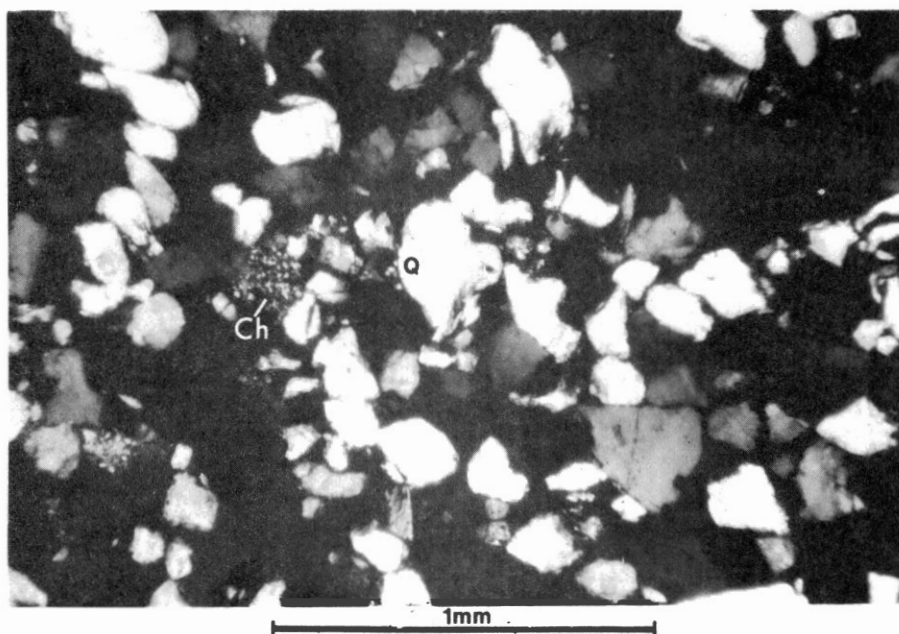


Figure 18. Medium-grained Quartzarenite From a Lenticular Sandstone in Sec. 5, T17N, R7E. (Q=Quartz, Ch=Chert)

contains 5 percent feldspar. The maximum chert content of 7 percent is present in a sandstone immediately east of Drumright (Figure 19). Cements, including illite/sericite, limonite, hematite, and calcite, have a patchy distribution. Calcite and secondary kaolinite are present in one sample from the Hominy area in Sec. 19, T22N, R8E (Figure 20).

Four of five samples of thin-bedded sandstones are quartzarenites, with 3 to 4 percent feldspar (Figure 21). The fifth sample, a subarkose with 5 percent feldspar, is from a sandstone in the Milfay area (Sec. 4, T14N, R7E). Thin-bedded units contain a higher proportion of interstitial clay and detrital muscovite than the lenticular sandstones. Accessory minerals, including tourmaline and zircon, are also more common in the finer grained, thin-bedded sandstones.

Wood fragments are prominent constituents in both lenticular and thin-bedded sandstones. The more finely divided plant material is generally present in the thin-bedded sandstones. Although a fauna of gastropods, pelecypods, and crinoid stems is essentially restricted to thin-bedded sandstones, these fossil types are present in the basal part of a lenticular unit in the Hominy area. A common constituent in the lower portion of lenticular sandstones is locally derived clasts of claystone, shale, and siltstone.

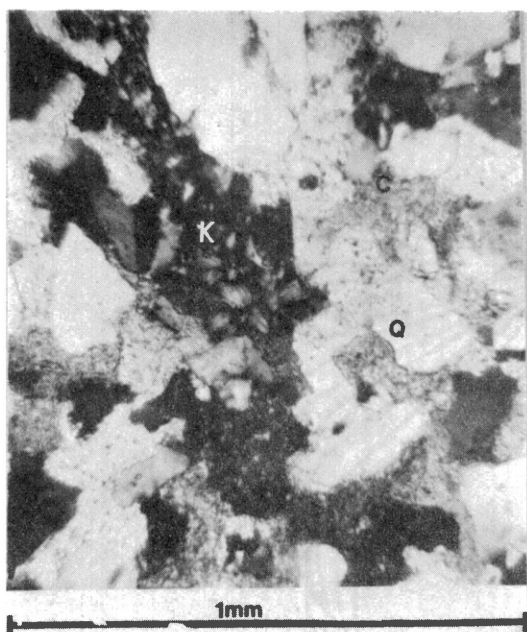


Figure 19. Calcite (C), Kaolinite (K), and Quartz (Q) in a Lenticular Sandstone From Sec. 19, T22N, R8E

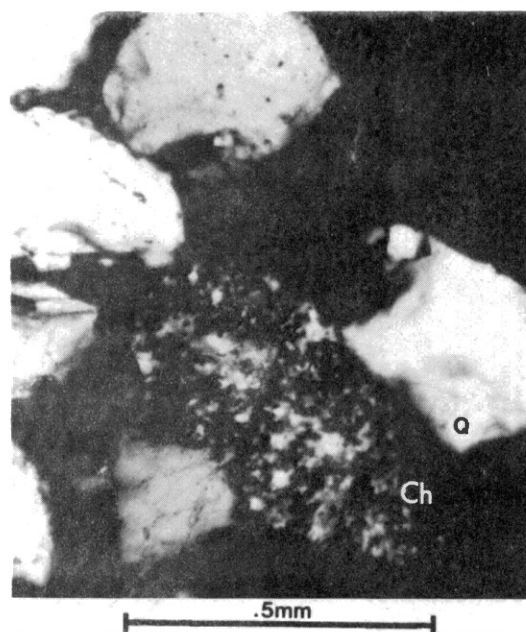


Figure 20. Chert (Ch) and Quartz Grains in a Lenticular Sandstone From Sec. 5, T17N, R7E

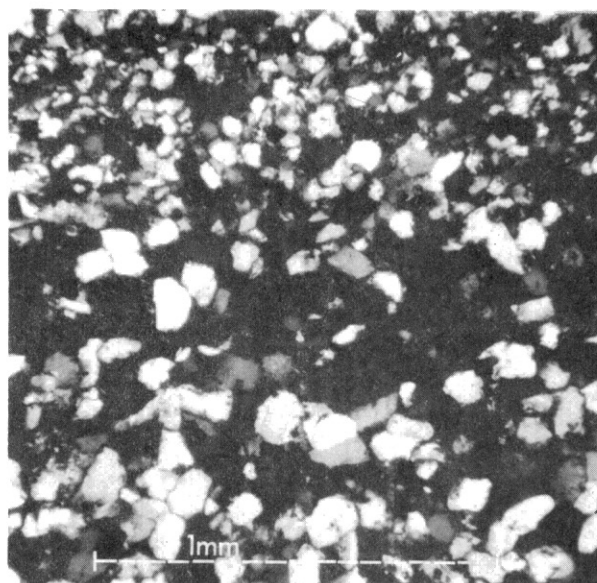


Figure 21. Very Fine- to Fine-grained Quartzarenite From a Thin-bedded Sandstone in Sec. 8, T18N, R7E

CHAPTER VI

DEPOSITIONAL ENVIRONMENT

In the study interval, major sandstone development is represented by multistoried and multilateral, lenticular sandstones. Genesis of these sandstones may be inferred from their respective geometries and internal features. Thin, narrow lenticular sandstone bodies which are common in the lower part of the study interval, probably correspond to deltaic distributaries. Larger lenticular units are prominent in the upper part of the study interval, and they are thought to represent alluvial channels. Shaw Ranch distributaries were generally less than 200 feet in width, whereas river widths were probably as much as 300 feet. Distributary and alluvial channel deposits attained maximum thickness of 20 to 30 feet, respectively.

Diagnostic features for both types of sandstones are: (1) sharp upper and lower contacts and abrupt lateral contacts; (2) medium-scale crossbedding, cut-out, parting lineation, initial dip, and paleocurrent directions which are fairly consistent with local sandstone trends; (3) fine- to medium-grain size, some fining-upward sequences, and good sorting, and (4) intraformational fragments and wood fragments. Other criteria which are useful in distinguishing distributary sandstones are the finer grain size (very fine- to fine-grained) and prominence of small-scale crossbedding and deformed bedding.

Thin-bedded sandstones are interpreted to be shallow marine or

delta-fringe units. The latter is preferred primarily because of the association with channel sandstones and limited lateral distribution of individual units. These sandstones were probably deposited in interdistributary areas or seaward of advancing streams, which later partially eroded the delta-front units. Characteristic features of the delta-fringe units are: (1) gradational lower and lateral contacts; (2) small-scale crossbedding, relatively low-angle initial dip, ripple marks, parting lineation, interstratification, and wide range in paleocurrent indicators; (3) very fine grain size and good sorting, and (4) fossils, burrows, trails, and bioturbated bedding.

Comparison of sandstone distribution of the Shaw Ranch with that of the Elgin in the study area indicates that the latter is more extensively developed; the proportion of lenticular sandstones is higher, particularly in T21-25N. Alluvial sandstones in the study interval apparently did not reach the stage of development of that represented by the Elgin Sandstone. Elgin rivers built an alluvial plain which extended north and northwestward to the southern boundary of T19N. However, during maximum regression associated with deposition of the Shaw Ranch Sandstone, alluvial-plain development extended only to the central part of T17N. Delta-fringe units are poorly developed or preserved in the Shaw Ranch Sandstone in the southern part of the area; sandstone development in T20-25N is primarily represented by the thin-bedded units.

Local parts of the study area during deposition were subject to marine conditions, based on the presence of a thin, fusulinid-bearing, quartzose calcarenite in the central part of T16N, R7E. Limestone and/or calcareous sandstone are also present in the subsurface along the

eastern margin of T22N-24N, R7E. In that area, limestone usually ranges from 5 to 10 feet in thickness; however, it attains a maximum thickness of 60 feet at one locality (Sec. 13, T24N, R7E).

Deposition of shallow-marine units associated with the lower shale marker formed during a transgression which advanced into the study area from the north. Cut-outs in the uppermost part of the Elgin sandstone apparently represent small creeks which formed on a tidal flat during the initial stages of the transgression. Deposition of the Shaw Ranch Sandstone began during the ensuing regression. As the delta prograded north- northwestward, distributaries advanced over delta-fringe deposits. During maximum regression, an alluvial plain, which was built on deltaic deposits, occupied the southernmost part of the study area (Figure 22). Although distributaries and rivers had considerable range in their orientations, paleocurrent data indicates an overall trend on N25⁰W. Current directions in the delta-fringe units adjacent to the distributaries were also diverse. Sediments were derived, to a large extent, from the Ouachita uplift and secondarily from the Arbuckle uplift. These source areas are indicated by paleocurrents and regional distribution of sandstone, and significant chert content is suggestive of the Ouachita system as the source.

Deposition of the Shaw Ranch Sandstone was terminated by a transgression associated with the upper marker of the study interval. Although the basal part of the Lecompton Limestone has generally been regarded as representative of the transgression, the initial phase of the transgression may be represented in some part of the maroon-to-gray shales which underlie the Lecompton. The interval containing the Shaw Ranch Sandstone is recognized as the final of four regressive phases in the overall regressive Vamoosa wedge.

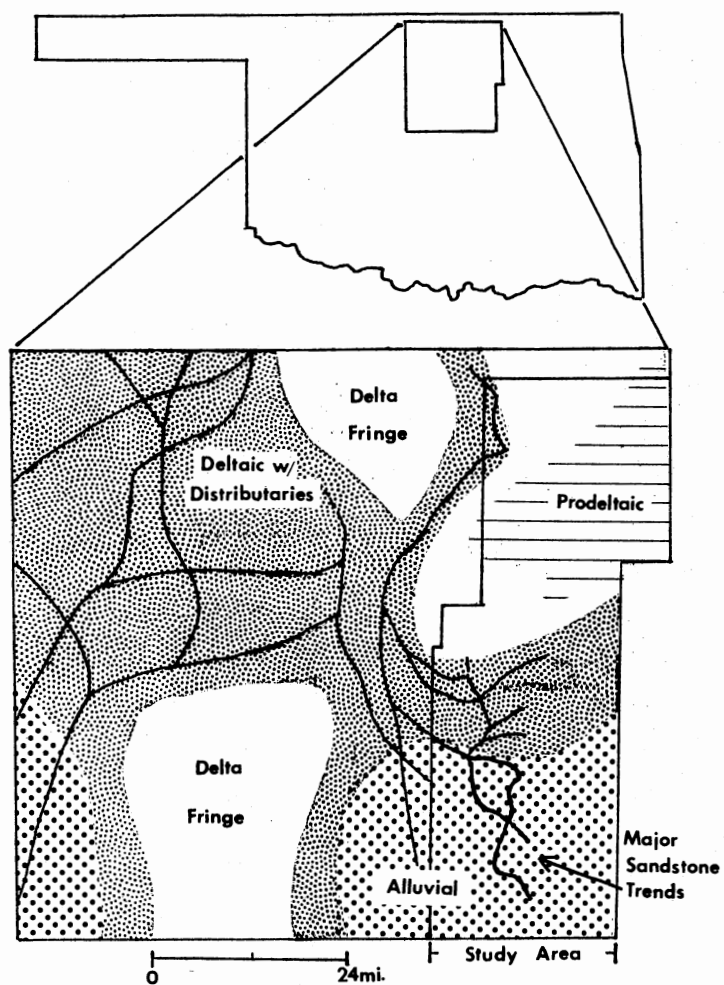


Figure 22. Paleogeography of Study Area and North-central Oklahoma During Maximum Regression; Part Modified After Souter (1966)

CHAPTER VII

DEPOSITIONAL TRENDS IN THE LECOMPTON LIMESTONE

The Lecompton Limestone in the subsurface is regarded as the basal member of the Pennsylvanian Pawhuska Formation, whereas on outcrop beds overlying the Lecompton are assigned to the Ada Formation. The lowermost part of this unit corresponds to the transgression which followed deposition of the Shaw Ranch Sandstone member of the underlying Vamoosa Formation. Gross depositional trends were determined primarily through study of thicknesses and, to some extent, sedimentary structures. A more detailed study concerning the petrography of this limestone has recently been conducted by Mistretta (1975).

The Lecompton, which generally changes from a limestone to a dolomite in a southward direction, is divided into six groups on the basis of development on outcrop and in the subsurface. Limestone is considered to be very well developed where total thickness exceeds 10 feet, well developed where it is 5 to 10 feet thick, and poorly developed where it is less than 5 feet thick. The presence of shale and sandstone is utilized in subdividing the very well developed units into three groups: massive limestone, limestone with interbedded shale, and sandy limestone or calcareous sandstone. The sixth group is poorly developed but thick, and is probably clayey limestone or calcareous shale. Maximum thickness of the Lecompton is about 45 feet.

The Lecompton is very well developed in a large portion of the

study area (Figure 23). The presence of a rather massive, unbroken sequence of limestone is restricted to three areas. Limestone in T18N, R6-7E, shows a northeast trend, and the area partially corresponds to that of major development of the underlying sandstone member. The area of relatively thick limestone may have been slightly elevated during the transgression as a result of good sandstone development. Limestone is also very well developed in the northern part of the study area in T25N, R6-7E. There the thickness of the limestone is not related to trends in the underlying sandstone. The thin interval of the Shaw Ranch Sandstone (Figure 8) suggests the possibility of paleostructural influence on deposition of the limestone. The third area, T22N, R7-8E, is local in extent, and deposition apparently was not related to variations in the underlying section.

Areas of poorly developed limestone and of apparent non-deposition of the Lecompton are present in the southern part of the study area and in T20N, R5E, and T21-22N, R6E. The absence in the south is consistent with the increase in terrigenous clastics in that direction. The area immediately north of good sandstone development in the Shaw Ranch may be related to changes in the underlying sandstone, which during the Lecompton transgression was possibly expressed by shoals and associated slopes.

Sedimentary structures characteristic of the Lecompton include large- and medium-scale crossbedding, wavy bedding, and interstratification. Large-scale and medium-scale crossbedding are associated with a skeletal calcarenite in the basal part of the Lecompton in the Jennings area (southeastern part of T20N, R7E). These crossbedded calcarenites are thought to represent deposition in tidal channels on a

carbonate shelf (Rowland, in Shelton and Rowland, 1974). Features which are more typical of the Lecompton include wavy bedding and interstratification (Figure 24). Individual wavy beds range from 2 to 6 inches in thickness. However, they are as much as one foot thick where the Lecompton is dolomite (Mistretta, 1975). Algal mudstones and wackestones constitute the thickest unit of the Lecompton. Deposition of this unit is thought to have occurred in an intertidal to subtidal environment (Rowland, in Shelton and Rowland, 1974). On outcrop, the Lecompton does not generally display massive bedding; beds near the upper part of the unit may be as thick as 1.5 to 2 feet thick (Figure 25). The presence of thick sequences of limestone in the subsurface of the northern part of the study area suggests that the Lecompton there may be more massive. Massive Pennsylvanian limestones, composed chiefly of algal blades and platelets, carbonate mud, and sparry calcite are common in both northeastern Oklahoma and southeastern Kansas. These limestones commonly represent algal banks or mounds (Frost, 1975; Heckel and Cocke, 1969). Development of similar mound or bank facies in the Lecompton Limestone may occur in areas where it attains its greatest thickness.



Figure 24. Wavy Bedding and Interstratification in Lecompton Limestone, in an Abandoned Quarry, West of Hominy (Sec. 3, T22N, R8E)



Figure 25. Very well Developed Algal Mudstones and Wackestones in the Lecompton Limestone in Sec. 3, T22N, R8E

CHAPTER VIII

SUMMARY

The principal conclusions of this study are as follows:

1. The Shaw Ranch Sandstone represents the final regressive phase of the Vamoosa Formation during which deltaic-alluvial sediments were deposited. An alluvial plain built on deltaic deposits was constructed in the southern part of the study area. Shaw Ranch sediments were derived largely from the Ouachita uplift, possibly together with the Arbuckle uplift, based on regional distribution of sandstone, paleocurrent data, and chert content of sandstone in the study interval.

2. Major sandstone development in the Shaw Ranch Sandstone is represented by multistoried and multilateral lenticular sandstones. These sandstones are present in belts which are generally 1 to 3 miles wide and 80 to 120 feet in thickness. Individual genetic units, which range from 5 to 25 feet in thickness and 100 to over 300 feet in width, are best developed in the Drumright-Shamrock area.

3. Lenticular sandstones represent alluvial and distributary deposits. Alluvial channel sandstones are more extensively developed laterally than distributary sandstones. Sharp, erosional lower and lateral contacts characterize both genetic units.

4. Channel sandstones exhibit medium-scale crossbedding, cut-out, and high-angle initial dip. Although the range in paleocurrent

directions is wide, the overall direction for the lenticular units is north-northwest.

5. Alluvial sandstones are generally coarser-grained than the distributary sandstones. Some lenticular sandstone bodies contain fining-upward sequences. Sandstones in the study interval are dominantly quartzarenites, with 4 to 7 percent chert.

6. Thin-bedded sandstones are delta-fringe units, which have gradational lower and lateral contacts. Individually, these sandstones are thinner and more persistent in lateral extent than lenticular genetic units. Thin-bedded units are best developed in the northern part of the study area.

7. Characteristic sedimentary structures of the thin-bedded sandstones are small- and medium-scale crossbedding, parting lineation, ripple marks, and bioturbated bedding. Thin-bedded units, which range widely in paleocurrent directions, show a primary average trend of N60°E and a secondary direction of N35°W.

8. Thin-bedded sandstones are very fine- to fine-grained, sub-angular, and well sorted. Petrographic analyses of these units indicate a range in composition from quartzarenite to quartz-rich subarkose.

9. Degree of development of the Lecompton Limestone may be related in part to variations in thickness of the underlying Shaw Ranch Sandstone. In some cases, paleostructure may have influenced limestone deposition.

10. Sedimentary structures in the Lecompton Limestone are medium- and large-scale crossbedding, wavy bedding, and interstratification. Deposition of the limestone was in environments ranging from intertidal

to subtidal areas on a broad shelf.

11. Areas in which the Lecompton is more massively developed, particularly in the subsurface, may represent algal banks and/or mounds typical of Upper Pennsylvanian limestones in northeastern Oklahoma or southeastern Kansas.

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APPENDIX A

KEY MEASURED SECTIONS

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728		0-729		0-730		0-731		0-732		0-733		0-734		0-735		0-736		0-737		0-738		0-739		0-740		0-741		0-742		0-743		0-744		0-745		0-746		0-747		0-748		0-749		0-750		0-751		0-752		0-753		0-754		0-755		0-756		0-757		0-758		0-759		0-760		0-761		0-762		0-763		0-764		0-765		0-766		0-767		0-768		0-769		0-770		0-771		0-772	
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MEDIUM-SCALE		PEBBLE		SMALL-SCALE		PLANT		LOW-ANGLE		STREAK		RIPPLE MARKS		PARTING		IRREGULARITIES		RIPPLE MARKS		CUT-OUTS, TRUNCATIONS, ETC.		IRREGULARITIES		DEFORMED & DISRUPTED		CUT-OUTS, TRUNCATIONS, ETC.		FLOWAGE, MUD CRACKS, ETC.		DEFORMED & DISRUPTED		CHEMICAL		FLOWAGE, MUD CRACKS, ETC.		CONCRETIONS, COME-IN-CONCRETE		CHEMICAL		MOTTLED		CONCRETIONS, COME-IN-CONCRETE		SURROWS, TRAILS, ETC.		MOTTLED		COBBLE		SURROWS, TRAILS, ETC.		PEBBLE		COBBLE		GRANULE		PEBBLE		V. COARSE		GRANULE		COARSE		V. COARSE		MEDIUM		COARSE		FINE		MEDIUM		V. FINE		FINE		SILT		V. FINE		VERY WELL		SILT		POOR		VERY WELL		MICA		POOR		SILTITE (S) SILTITE (S)		MICA		SILTITE (S)		SILTITE (S) SILTITE (S)		GLAUCONITE		SILTITE (S)		CARBONATE		GLAUCONITE		CHERT (C)		CARBONATE		ROCK FRAGMENTS (RF)		CHERT (C)		INTRAFORMATIONAL FRAGMENTS		ROCK FRAGMENTS (RF)		INTERSTITIAL		INTRAFORMATIONAL FRAGMENTS		CLAY		INTERSTITIAL		CARBONACEOUS MATERIAL (C)		CLAY		CARBONIZED WOOD (W)		CARBONACEOUS MATERIAL (C)		FAUNA		CARBONIZED WOOD (W)		COLOR		FAUNA		POROSITY (%)		COLOR		REFERENCE NUMBER		POROSITY (%)		SAMPLE NUMBER		REFERENCE NUMBER				SAMPLE NUMBER	
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SE SW Sec. 9, T. 16N R. 7E		Map	
SWSE 8 Co., Creek Co., OKIA.		Section No. 21	
Area along road on knoll		By J. Shalton	
Outcrop Pattern - Linear		Formation	
FOOTAGE		ENVIRONMENT	
DIRECTIONAL DATA		LITHOLOGY	
0.1 LATERAL EXTENT		SEDIMENTARY STRUCTURES	
0.2 LATERAL EXTENT		MECHANICAL	
0.5 LATERAL EXTENT		TEXTURE	
1.0 (WIDTH IN MILES)		GRAIN SIZE	
2.0		MAX. 1	
MASSIVE		SCOTTING	
HORIZONTAL (S.L.)		CONSTITUENTS	
INTERSTRATIFIED (S.L.)		MICA	
GRADED (S.L.)		BLAUCONITE	
LARGE-SCALE		CARBONATE	
MEDIUM-SCALE		CHERT (C)	
SMALL-SCALE		ROCK FRAGMENTS (RF)	
LOW-ANGLE		INTRAFORMATIONAL	
FLUTES, GROOVES, STRIATIONS, ETC.		FRAGMENTS	
PEBBLE		INTERSTITIAL	
PLANT		EARLY (E)	
STREAK		CLAY	
PARTING		CARBONACEOUS MATERIAL (C)	
RIPPLE MARKS		CARBONIZED WOOD (W)	
IRREGULARITIES		FAUNA	
CUT-OUTS, TRUNCATIONS, ETC.		COLOR	
DEFORMED & DISRUPTED FLOWAGE, MUD CRACKS, ETC.		POROSITY (%)	
CHEMICAL		REFERENCE NUMBER	
CONCRETIONS, CONGLOMERATES, ETC.		SAMPLE NUMBER	
MOTTLED			
BURROWS, TRAILS, ETC.			
ORGANIC			
16,000 COBBLE			
64,000			
16,000 PEBBLE			
4,000			
GRANULE			
2,000			
V. COARSE			
1,000			
COARSE			
500			
MEDIUM			
250			
FINE			
125			
V. FINE			
62.5			
SILT			
31.25			
VERY WELL			
1.5			
1.4			
2.0			
POOR			
MICA			
MOTTLE (M) MOTTLE (M)			
CHLORITE (C)			
BLAUCONITE			
CARBONATE			
CHERT (C)			
ROCK FRAGMENTS (RF)			
INTRAFORMATIONAL			
FRAGMENTS			
INTERSTITIAL			
EARLY (E)			
CLAY			
CARBONACEOUS MATERIAL (C)			
CARBONIZED WOOD (W)			
FAUNA			
COLOR			
POROSITY (%)			
REFERENCE NUMBER			
SAMPLE NUMBER			

1--Thickest part on west side of hill in section 8

0 20

315

1

NW Sec. 33 T. 17N R. 7E		Map	Photo																																																																																																		
Creek Co. Okla.		Section No. 27																																																																																																			
Area Shamrock (east side)		Structural Dip	By J. Shelton																																																																																																		
Outcrop Pattern -- Linear		half	Formation																																																																																																		
FOOTAGE ENVIRONMENT DIRECTIONAL DATA	LITHOLOGY	SEDIMENTARY STRUCTURES										TEXTURE										CONSTITUENTS										FAUNA	COLOR	PRIORITY (%)	REFERENCE NUMBER	SAMPLE NUMBER																																																																	
		MECHANICAL										GRAIN SIZE										SORTING																																																																															
		STRATIFICATION					LINEATION					AVG.					MAX.					SORTING																																																																															
		Bedded (B) Laminated (L)					ENOS DEPOSITION					PERCENT					PERCENT					PERCENT																																																																															
		CL-02 LATERAL EXTENT	CL-01 LATERAL EXTENT	CL-03 LATERAL EXTENT	CL-04 LATERAL EXTENT	CL-05 LATERAL EXTENT	CL-06 LATERAL EXTENT	CL-07 LATERAL EXTENT	CL-08 LATERAL EXTENT	CL-09 LATERAL EXTENT	CL-10 LATERAL EXTENT	CL-11 LATERAL EXTENT	CL-12 LATERAL EXTENT	CL-13 LATERAL EXTENT	CL-14 LATERAL EXTENT	CL-15 LATERAL EXTENT	CL-16 LATERAL EXTENT	CL-17 LATERAL EXTENT	CL-18 LATERAL EXTENT	CL-19 LATERAL EXTENT	CL-20 LATERAL EXTENT	CL-21 LATERAL EXTENT	CL-22 LATERAL EXTENT	CL-23 LATERAL EXTENT	CL-24 LATERAL EXTENT	CL-25 LATERAL EXTENT	CL-26 LATERAL EXTENT	CL-27 LATERAL EXTENT	CL-28 LATERAL EXTENT	CL-29 LATERAL EXTENT	CL-30 LATERAL EXTENT	CL-31 LATERAL EXTENT	CL-32 LATERAL EXTENT	CL-33 LATERAL EXTENT	CL-34 LATERAL EXTENT	CL-35 LATERAL EXTENT	CL-36 LATERAL EXTENT	CL-37 LATERAL EXTENT	CL-38 LATERAL EXTENT	CL-39 LATERAL EXTENT	CL-40 LATERAL EXTENT	CL-41 LATERAL EXTENT	CL-42 LATERAL EXTENT	CL-43 LATERAL EXTENT	CL-44 LATERAL EXTENT	CL-45 LATERAL EXTENT	CL-46 LATERAL EXTENT	CL-47 LATERAL EXTENT	CL-48 LATERAL EXTENT	CL-49 LATERAL EXTENT	CL-50 LATERAL EXTENT	CL-51 LATERAL EXTENT	CL-52 LATERAL EXTENT	CL-53 LATERAL EXTENT	CL-54 LATERAL EXTENT	CL-55 LATERAL EXTENT	CL-56 LATERAL EXTENT	CL-57 LATERAL EXTENT	CL-58 LATERAL EXTENT	CL-59 LATERAL EXTENT	CL-60 LATERAL EXTENT	CL-61 LATERAL EXTENT	CL-62 LATERAL EXTENT	CL-63 LATERAL EXTENT	CL-64 LATERAL EXTENT	CL-65 LATERAL EXTENT	CL-66 LATERAL EXTENT	CL-67 LATERAL EXTENT	CL-68 LATERAL EXTENT	CL-69 LATERAL EXTENT	CL-70 LATERAL EXTENT	CL-71 LATERAL EXTENT	CL-72 LATERAL EXTENT	CL-73 LATERAL EXTENT	CL-74 LATERAL EXTENT	CL-75 LATERAL EXTENT	CL-76 LATERAL EXTENT	CL-77 LATERAL EXTENT	CL-78 LATERAL EXTENT	CL-79 LATERAL EXTENT	CL-80 LATERAL EXTENT	CL-81 LATERAL EXTENT	CL-82 LATERAL EXTENT	CL-83 LATERAL EXTENT	CL-84 LATERAL EXTENT	CL-85 LATERAL EXTENT	CL-86 LATERAL EXTENT	CL-87 LATERAL EXTENT	CL-88 LATERAL EXTENT	CL-89 LATERAL EXTENT	CL-90 LATERAL EXTENT	CL-91 LATERAL EXTENT	CL-92 LATERAL EXTENT	CL-93 LATERAL EXTENT	CL-94 LATERAL EXTENT	CL-95 LATERAL EXTENT	CL-96 LATERAL EXTENT	CL-97 LATERAL EXTENT	CL-98 LATERAL EXTENT	CL-99 LATERAL EXTENT	CL-100 LATERAL EXTENT

SW NW
to SW

Sec. 37

T. 18N R. 7E

Creek

Co., Okla.

Area #20 from bridge North

Structural Dip

Outcrop Pattern - Linear

bed

Formation

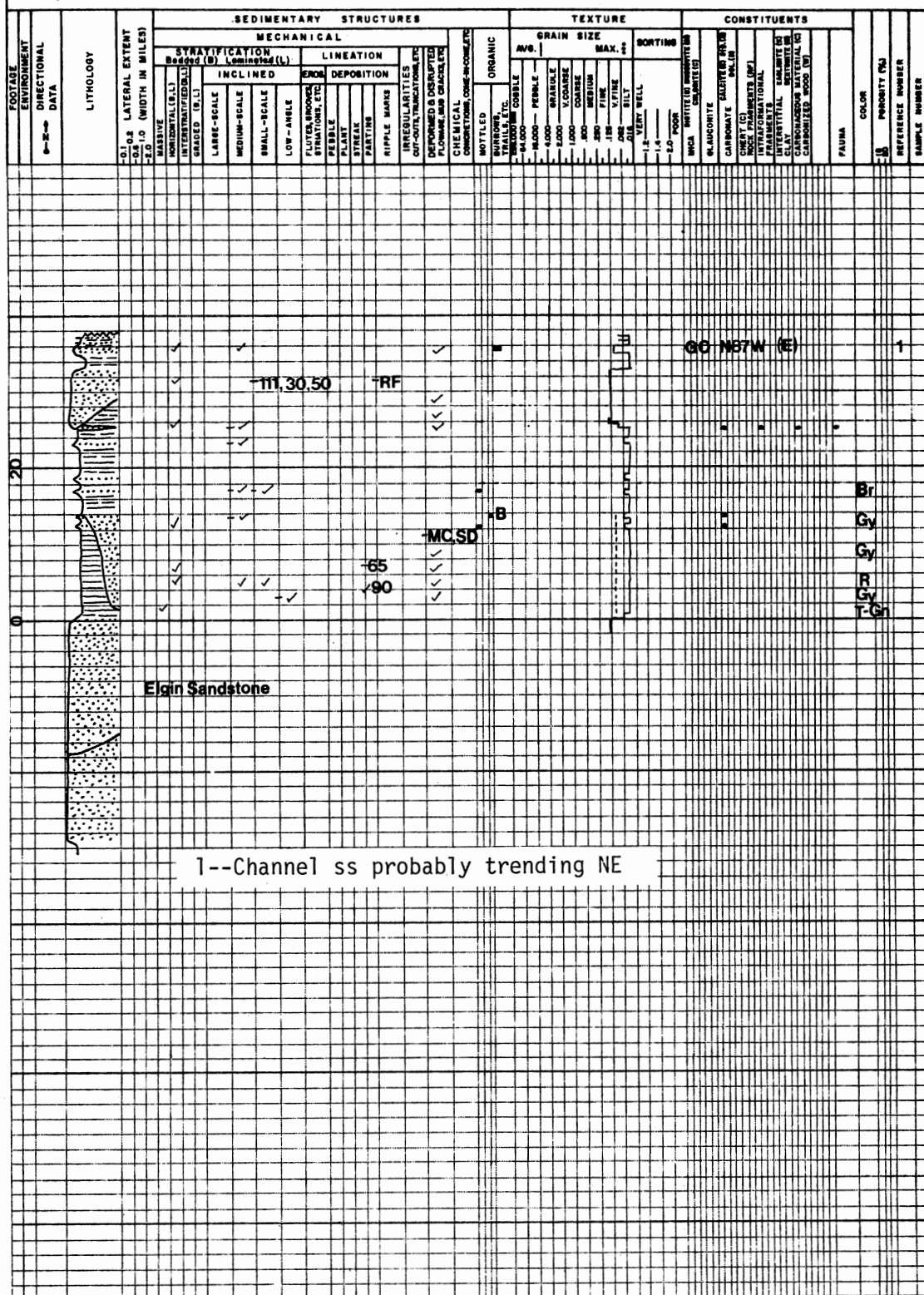
Map

Section No. 30

By J. Shelton

FOOTAGE ENVIRONMENT DIRECTIONAL DATA	LITHOLOGY	SEDIMENTARY STRUCTURES															TEXTURE										CONSTITUENTS										FAUNA	COLOR	POROSITY (%)	REFERENCE NUMBER
		MECHANICAL															GRAIN SIZE										SORTING													
		STRATIFICATION					LINEATION					EROSION					AVG.					MAX.					SORTING													
		Bedded (B) Laminated (L)					Deposition					Flutes, Grooves, Striations, Etc.					Silt					Sand					Gravel													
		B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L													
<div> <div>0-10</div> <div>10-20</div> <div>20-30</div> <div>30-40</div> <div>40-50</div> <div>50-60</div> <div>60-70</div> <div>70-80</div> <div>80-90</div> <div>90-100</div> </div>	<div> <div>0-10</div> <div>10-20</div> <div>20-30</div> <div>30-40</div> <div>40-50</div> <div>50-60</div> <div>60-70</div> <div>70-80</div> <div>80-90</div> <div>90-100</div> </div>																																							
<div> <div>1--possible error in measuring section 37, logged over long distance North dip of beds</div> </div>																																								

NW+SW Sec. 9 T. 18N R. 7E Map _____ Photo _____
Creek _____ Co., Okl. Section No. 37
Area Same at 10 roadcut to S Structural Dip _____ By J. Shelton
Outcrop Pattern -- Linear _____ belt _____ Formation _____



NE 1/4 Sec. 14 T. 20N R. 7E		Map	
Pawnee Co. Okla.		Section No. 52A	
Area W from NE corner to small hill S of road		By J. Shelton	
Outcrop Pattern - Linear		bait	
FORMATION		Photo	
FOOTAGE		ENVIRONMENT	
DIRECTIONAL DATA		LITHOLOGY	
0.1 LATERAL EXTENT		0.1 LATERAL EXTENT	
0.5 LATERAL EXTENT		0.5 LATERAL EXTENT	
1.0 LATERAL EXTENT		1.0 LATERAL EXTENT	
2.0 LATERAL EXTENT		2.0 LATERAL EXTENT	
MASSIVE		MASSIVE	
HORIZONTAL (B, L)		HORIZONTAL (B, L)	
INTERSTRATIFIED (B, L)		INTERSTRATIFIED (B, L)	
GRADED (B, L)		GRADED (B, L)	
LARGE-SCALE		LARGE-SCALE	
MEDIUM-SCALE		MEDIUM-SCALE	
SMALL-SCALE		SMALL-SCALE	
LOW-ANGLE		LOW-ANGLE	
FLUTES, GROOVES, STRIATIONS, ETC.		FLUTES, GROOVES, STRIATIONS, ETC.	
PEBBLE		PEBBLE	
PLANT		PLANT	
STREAK		STREAK	
PARTING		PARTING	
RIPPLE MARKS		RIPPLE MARKS	
IRREGULARITIES		IRREGULARITIES	
OUT-OUTLINATIONS, ETC.		OUT-OUTLINATIONS, ETC.	
DEFORMED & DISRUPTED FLOWING, ETC.		DEFORMED & DISRUPTED FLOWING, ETC.	
CHEMICAL CONCRETIONS, COME-IN-COME, ETC.		CHEMICAL CONCRETIONS, COME-IN-COME, ETC.	
MOTTLED		MOTTLED	
BURROWS, TRAILS, ETC.		BURROWS, TRAILS, ETC.	
COBBLE		COBBLE	
GRAVEL		GRAVEL	
GRANULE		GRANULE	
V. COARSE		V. COARSE	
COARSE		COARSE	
MEDIUM		MEDIUM	
FINE		FINE	
V. FINE		V. FINE	
SILT		SILT	
VERY WELL		VERY WELL	
POOR		POOR	
MICA		MICA	
BIOHITE (B) BROWHITE (B)		BIOHITE (B) BROWHITE (B)	
GLAUCONITE		GLAUCONITE	
CARBONATE		CARBONATE	
CHERT (C)		CHERT (C)	
ROCK FRAGMENTS (R)		ROCK FRAGMENTS (R)	
INTRAFORMATIONAL FRAGMENTS		INTRAFORMATIONAL FRAGMENTS	
INTERSTITIAL EARTHEN (E)		INTERSTITIAL EARTHEN (E)	
CLAY		CLAY	
CARBONACEOUS MATERIAL (C)		CARBONACEOUS MATERIAL (C)	
CARBONIZED WOOD (W)		CARBONIZED WOOD (W)	
FAUNA		FAUNA	
COLOR		COLOR	
POROSITY (%)		POROSITY (%)	
REFERENCE NUMBER		REFERENCE NUMBER	
SAMPLE NUMBER		SAMPLE NUMBER	

NW 1/4 Sec. 23 T. 21N R. 7E		Map	
Pawnee Co., Okla.		Section No. 58	
Area		Photo	
Outcrop Pattern - Linear		Structural Dip	
bell		Formation	
<div style="display: flex; justify-content: space-between;"> <div> <p>FOOTAGE</p> <p>ENVIRONMENT</p> <p>DIRECTIONAL DATA</p> </div> <div> <p>LITHOLOGY</p> <p>LATERAL EXTENT</p> <p>(WIDTH IN MILES)</p> <p>MASSIVE</p> <p>HORIZONTAL (B, L)</p> <p>INTERSTRATIFIED (B, L)</p> <p>GRADED (B, L)</p> <p>MECHANICAL</p> <p>STRUCTURAL</p> <p>STRUCTURES</p> <p>INCLINED</p> <p>LOW-ANGLE</p> <p>FLUTES, GROOVES, STRIATIONS, ETC.</p> <p>PEBBLE</p> <p>PLANT</p> <p>STREAK</p> <p>PARTING</p> <p>RIPPLE MARKS</p> <p>IRREGULARITIES</p> <p>CUT-OUTS, TRUNCATIONS, ETC.</p> <p>DEFORMED & DISRUPTED</p> <p>FLOWAGE, MUD CRACKS, ETC.</p> <p>CHEMICAL</p> <p>CONCRETIONS, COME-IN-CONCRETE, ETC.</p> <p>MOTTLED</p> <p>BURROWS, TRAILS, ETC.</p> <p>COBBLE</p> <p>GRAIN SIZE</p> <p>MAX</p> <p>SCOTTING</p> <p>POOR</p> <p>CONSTITUENTS</p> <p>FAUNA</p> <p>COLOR</p> <p>POROSITY (%)</p> <p>REFERENCE NUMBER</p> <p>SAMPLE NUMBER</p> </div> </div>			
<p>1--sandy ls or calcareous ss, fauna</p>			

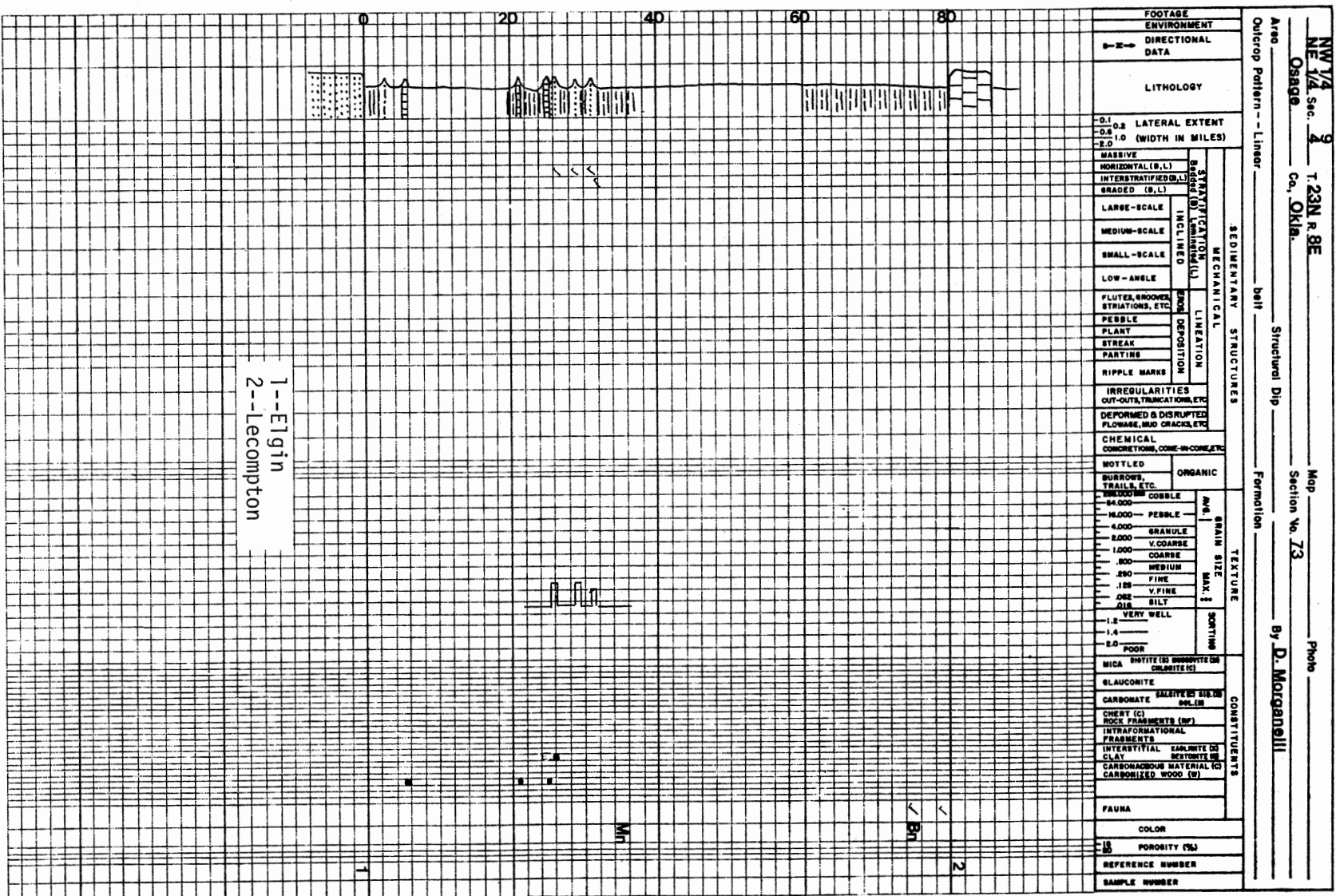
NE SW Sec. 3 T. 22N R. 8E		Map	
Osage Co., Okla.		Section No. 66	
Area		By D. Morganelli	
Outcrop Pattern - Linear		Dip	
bell		Formation	

FOOTAGE		ENVIRONMENT	
DIRECTIONAL DATA		LITHOLOGY	
LATERAL EXTENT		SEDIMENTARY STRUCTURES	
0.1 0.2 0.5 1.0 (WIDTH IN MILES)		MECHANICAL	
MASSIVE		STRUCTURE	
HORIZONTAL (B.L.)		INCLINED	
INTERSTRATIFIED (B.L.)		LINEATION	
GRADED (B.L.)		SPIN DEPOSITION	
LARGE-SCALE		FLUTES, GROOVES, STRIATIONS, ETC.	
MEDIUM-SCALE		PEBBLE	
SMALL-SCALE		PLANT	
LOW-ANGLE		STREAK	
IRREGULARITIES		PARTING	
OUT-OUT, TRUNCATIONS, ETC.		RIPPLE MARKS	
DEFORMED & DISRUPTED FLOWAGE, MUD CRACKS, ETC.		CHEMICAL	
CONCRETIONS, COME-IN-COME, ETC.		MOTTLED	
BURROWS, TRAILS, ETC.		ORGANIC	
GRAIN SIZE		TEXTURE	
MAX. 2		SORTING	
POOR		CONSTITUENTS	
MICA MOTTLE (IN SUBSTRATE) (CLAY) (CLAY) (CLAY)		GLAUCONITE	
CARBONATE		CHERT (C)	
ROCK FRAGMENTS (RF)		INTRAFORMATIONAL FRAGMENTS	
INTERSTITIAL		CLAY	
CARBONACEOUS MATERIAL (C)		CARBONIZED WOOD (W)	
FAUNA		COLOR	
POROSITY (%)		REFERENCE NUMBER	
SAMPLE NUMBER		SAMPLE NUMBER	

1--lecompton--thin, wavy bedding (< 6 in. in most cases)

2--more massive toward top, bed present > 1 ft. thick

SE. Sec. 20 T. 23N R. 8E		Map																																																																																																																																																																																																																																									
Osage Co., Okla.		Section No. 72																																																																																																																																																																																																																																									
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FLUTES, BROOKS, STRATIONS, ETC.		PEBBLE		PEBBLE		PLANT		PLANT		STREAK		STREAK		PARTING		PARTING		RIPPLE MARKS		RIPPLE MARKS		IRREGULARITIES		IRREGULARITIES		CUT-OUTS, TRACATIONS, ETC.		CUT-OUTS, TRACATIONS, ETC.		DEFORMED & DISRUPTED		DEFORMED & DISRUPTED		FLOWAGE, MUD CRACKS, ETC.		FLOWAGE, MUD CRACKS, ETC.		CHEMICAL		CHEMICAL		CONCRETIONS, COME-IN-COME, ETC.		CONCRETIONS, COME-IN-COME, ETC.		MOTTLED		MOTTLED		BURROWS, TRAILS, ETC.		BURROWS, TRAILS, ETC.		COBBLE		COBBLE		PEBBLE		PEBBLE		GRANULE		GRANULE		V. COARSE		V. COARSE		COARSE		COARSE		MEDIUM		MEDIUM		FINE		FINE		V. FINE		V. FINE		SILT		SILT		VERY WELL		VERY WELL		POOR		POOR		MICA		MICA		SILICATE (IN MOUNTAIN)		SILICATE (IN MOUNTAIN)		CHLORITE (C)		CHLORITE (C)		GLAUCONITE		GLAUCONITE		CARBONATE		CARBONATE		CHERT (C)		CHERT (C)		ROCK FRAGMENTS (RF)		ROCK FRAGMENTS (RF)		INTRAFORMATIONAL		INTRAFORMATIONAL		FRAGMENTS		FRAGMENTS		INTERSTITIAL		INTERSTITIAL		SANDSTONE (S)		SANDSTONE (S)		CLAY		CLAY		CARBONACEOUS MATERIAL (C)		CARBONACEOUS MATERIAL (C)		CARBONIZED WOOD (W)		CARBONIZED WOOD (W)		FAUNA		FAUNA		COLOR		COLOR		POROSITY (%)		POROSITY (%)		REFERENCE NUMBER		REFERENCE NUMBER		SAMPLE NUMBER		SAMPLE NUMBER	
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APPENDIX B

LOCATION OF ELECTRIC LOGS USED IN PREPARATION OF CORRELATION SECTIONS

Well Number	Operator	Lease	Location
1	W. O. Smith	Battles 1	NE Sec. 30-14N-5E
2	Youngblood and Youngblood	Handley 1	NWNESE Sec. 26-14N-5E
3	Deeprook Oil Co.	Applegate 3	SWNWNE Sec. 24-14N-5E
4	Harper-Turner	Shaw 1	SESENE Sec. 30-14N-6E
5	Creslenn Oil Co.	Scott 1	SWNWNW Sec. 27-14N-6E
9	Rex Moore Jr.	Bishop 1	SESESW Sec. 9-15N-5E
10	Blackwell Oil Co.	Dye 4	NWNENW Sec. 34-15N-5E
11	W. C. McBride Inc.	State E-3	SWNESE Sec. 36-15N-5E
11A	Southland Royalty	Kendrick 1	NWNWNW Sec. 12-15N-5E
12	Vierson, Hayes and Means	Hopkins 1	NWNESE Sec. 31-15N-6E
13	McElreath, Harvey and Hayes	Criess 2	NENESW Sec. 34-15N-6E
13A	Ben J. Taylor	Anglin 1	SESENE Sec. 14-15N-6E
15	Austin-Dunham	Reeder 1	SESESE Sec. 19-16N-5E
16	Blackwell Oil Co.	Hoskin 1	NENESW Sec. 21-16N-5E
17	E. F. Moran Inc.	Hermann 1	SENWSE Sec. 24-16N-5E
17A	K. S. Oil Co.	Oestman 1	NENENW Sec. 1-16N-5E
18	Harper-Turner	Homer 1	SENESE Sec. 20-16N-6E
19	Inland Producing Co.	Murphy 1	NENENW Sec. 26-16N-6E
19A	Big Bend Petrol. Co.	Cook 1	SWSWNE Sec. 3-16N-6E
19B	Kemp, Ketchum and Whan Dr1g.	Cook 1	NENESW Sec. 27-17N-6E
20	Mid-Cont. Petrol.	Estates 1	NESENE Sec. 19-16N-6E
22	D and L Oil	Boettler 1	SESESE Sec. 17-17N-5E
23	Emby Kay	Fick 1	NENW Sec. 22-17N-5E

Well Number		Lease	Location
24	Wood Oil	Haskins 1	SWSWSE Sec. 24-17N-5E
24A	Continental and F. Weimer	Brennan 1	NENESE Sec. 1-17N-5E
24B	Globe Oil Co.	E. Harbin 3	NENWNE Sec. 23-18N-5E
25	R. C. Jones Co.	Griffith 1	SESWSW Sec. 18-17N-6E
26	Foster Drlg. Co.	Patterson 1	NWNWSE Sec. 10-17N-6E
26A	T. N. Berry Co.	Davenport 1	SESWNE Sec. 34-18N-6E
31	Thompson Tye Drlg. Co.	Carter 1	NWNWNE Sec. 7-18N-5E
32	Blackwell Oil Co.	Fisher 2	SWNWSW Sec. 9-18N-5E
33	Hydrocarbons Dev't. Corp.	Koble 1	NESWNW Sec. 12-18N-5E
33A	Texas Co.	Laughlin 1	SENWSE Sec. 35-19N-5E
34	H. Waggoner Co.	Griffith 1	NENESW Sec. 7-18N-6E
35	Okla. Gas	Wetzel 1	NWNENW Sec. 10-18N-6E
35A	Massad Oil	Everett 1	NWNESW Sec. 26-19N-6E
36	W. H. Martgan	L. Scott 1	SESENW Sec. 18-18N-7E
38	Midwestern Constrs. Inc.	Wetzel 1	NENENW Sec. 18-19N-5E
39	Joe S. Anderson	Kerby 1	SENESE Sec. 16-19N-5E
40	R. L. Parker	Hampton 2	SESESW Sec. 14-19N-5E
41	Carl Crites	Merritt 1	SENWSW Sec. 19-19N-6E
42	The Feagin Co.	Blankenship 2	NWSWSE Sec. 17-19N-6E
43	Falcon Seaboard Drlg. Co.	Reynolds 1	SESESW Sec. 2-19N-6E
45	Post Oak Oil	Vincent 1	NWNWNE Sec. 19-20N-5E
46	Lion Petrol. Co.	School Ld. 1	SWSWNE Sec. 16-20N-5E
47	J. B. Bradley	John Leen 1	SESESW Sec. 14-20N-5E

Well Number		Lease	Location
48	Apache Oil Co.	Gripe 1	NWNWSE Sec. 7-20N-6E
49	David Beach	Black 1	NW Sec. 15-20N-6E
50	Apache Oil Co.	Hope 1	NESWNE Sec. 24-20N-6E
51	Mid-Cont. Petrol.	M. Pettit 2	NESENW Sec. 17-20N-7E
53	McIntyre, Sherman, Cummings	Decker 1	SESESW Sec. 31-21N-6E
54	Sun Oil Co.	Ryan 1	SWSENE Sec. 33-21N-6E
55	Camtex Oil Co.	Lizar 1	NENWNE Sec. 35-21N-6E
55A	Western Oil and Gas	Meadors 1	SESWSW Sec. 10-21N-6E
56	L. L. Welker	Taulby 1	NWNWNW Sec. 31-21N-7E
57	T. O. Lilystrand	R. B. Tyler 1	SWSESW Sec. 28-21N-7E
59	T. C. Hudson	Gardner 1	SENESE Sec. 31-22N-6E
60	R. G. Woods	Pasley 1	NWSWNE Sec. 34-22N-6E
60A	R. B. Funkhouser	Funkhouser 1	NWNESW Sec. 10-22N-6E
60B	Jet Petrol. Corp.	Langdon 1	NWNWNW Sec. 35-23N-6E
61	Robert C. Davis	School Ld. 1	SWSWSE Sec. 36-22N-6E
62	Esperanza Oil	Helland 1	NWSESE Sec. 31-22N-7E
63	A. G. Oliphant	Franklin 4	NESWSW Sec. 34-22N-7E
63A	Clarke C. Nye	Roe 1	NESWSE Sec. 15-22N-7E
63B	Big Four Petrol.	Osage 5	NWNWNW Sec. 33-23N-7E
64	Tomar Petrol. Co.	Carson 1	SESWSW Sec. 19-22N-8E
64A	Sunray DX Oil	Osage 2	SW Sec. 31-23N-8E
64B	William Reilly Jr.	Osage 1	NWNESW Sec. 19-23N-8E
67	Apache Oil Co.	Worl 1	SWSWNE Sec. 16-23N-6E
68	Virgil Ball	Osage 1	SESENE Sec. 24-23N-6E

Well Number	Operator	Lease	Location
68A	Appleton Oil Co.	Schultz 1	NESESE Sec. 23-24N-6E
69	Calosage Syndicate	Thompson 1A	SWSWSE Sec. 17-23N-7E
69A	C. L. McMahon	Osage 1	NWNWSE Sec. 4-23N-7E
69B	Frank Buttram	Osage 1	NENENE Sec. 27-24N-7E
70	Toomey Oil Co.	Osage 1	NENENE Sec. 24-23N-7E
71	Pure Oil Co.	Osage 194	SWSWNE Sec. 17-23N-8E
74	D and L Oil Co.	Osage 1	NENESW Sec. 3-24N-6E
75	M. F. Ramsey	Osage 2	NW Sec. 1-24N-6E
76	Norman Rosser	Osage 1	SWSWSW Sec. 6-24N-7E
77	C. B. Peters Jr.	Osage 1	SWSWSE Sec. 4-24N-7E
78	Gross Drlg. Co.	Gross B-1	NWNWNE Sec. 1-24N-7E
79	H. H. Rosen	Osage 11	NESENW Sec. 7-24N-8E
82	A. G. Oliphant	Osage 1	SESWSW Sec. 7-25N-6E
83	Kewanee Oil Co.	Kern 5	SE Sec. 23-25N-6E
83A	Oras A. Shaw	Drummond 6	SESESW Sec. 1-25N-6E
84	Gross Prod. Co.	Osage 3-A	NWNWNE Sec. 18-25N-7E
85	J. M. Graves	Osage 2	NENESW Sec. 17-25N-7E
86	J. M. Graves	Osage 1-A	SWSWSW Sec. 15-25N-7E
86A	Davis and Wharton Drlg. Co.	K. Estate 2	SWSESE Sec. 3-25N-7E
87	Jet Petrol. Co.	Drummond 1	SESESW Sec. 6-25N-8E
89	Anderson Prichard	Osage 1	SWSWNW Sec. 22-25N-7E
90	J. P. Corbett	Roe 1	SWSWNE Sec. 5-23N-7E
91	Service Drlg. Co.	Osage 2	NENWSE Sec. 21-23N-6E
92	Frank Weimer	Brennan 1	NENESE Sec. 1-17N-5E

Well Number		Lease	Location
93	Homer Wright	Drummond 1-A	NENENE Sec. 27-24N-7E
94	Mul-berry Oil	Peters 1	NWSWSW Sec. 32-21N-6E

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VITA

Daniel Morganelli

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Master of Science

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THE VAMOOSA FORMATION AND LECOMPTON LIMESTONE IN THE EASTERN
PART OF NORTH-CENTRAL OKLAHOMA

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